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“ A NEW ACTIVITY ? ”



Elliot & Fry

Mrs Dickens

“A NEW ACTIVITY?”

A TREATISE ON

MRS. DICKINSON'S DISCOVERY
OF A “NEW RADIO-ACTIVITY”

(WITH SOME NOTES ON RADIUM)

BY

FRANK A. HOTBLACK

WITH A FOREWORD

BY

ALFRED W. OKE

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FOREWORD

BY

ALFRED W. OKE

B.A., LL.M., F.C.S., F.G.S., ETC.

“It appears to me, from what I have seen of the results of Mrs. Dickinson's experiments in connection with radio-active bodies, that her researches can best be described as ‘Radio-Activity in the Service of man.’”

June 5th, 1920.

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“ A NEW ACTIVITY ? ”

PART I

CHAPTER I

RADIUM

Radium—Its Origin.—Mendeléef,* as we know from his deep study of the relationship between the elements, prophesied in his table, the “ Periodic Series ” (Plate 1, page 160), the existence of certain elements then unknown. This wonderful foresight became an established fact in the following years, when, upon the discovery of Radium and other elements, they were found to correspond practically with the positions which had been destined for them.

This book, drawn up at the request of so many, is not claimed to be a “ magnum opus,” or a technical work ; it is merely as it were *only the opening chapter*, describing some of the work which has been carried out during recent years upon the “ activity ” in question. It solely suggests the possibility that this strange “ new activity ” (as it has been called) may be derived from one of the missing elements, or some compound of which up to the present very little has been known. It also ventures to forecast the great possibilities which may be found in “ radio ” or other activities. Before drawing an analogy or comparison between “ this activity ” and Radium, it is necessary to say, and most deservedly so, a few words about Radium itself. No originality is claimed for this particular chapter on “ Radium.” It is simply a repetition

* Professor, Russian chemist, 1834–1907.

of the generally known properties of Radium, gathered together from standard works, and only dealing with Radium in so far as it can be clearly understood by the general public; and also, and most important of all, as far as it concerns us, for reasons of the similarity or difference between this "newly discovered activity" and Radium, as far as experiments and research, which have been carried out upon it during the last few years, enable us to establish.

"Coming events cast their shadows before them."

The shadow of the realisation of "radio-activity" may be said to have been indirectly found when H. Becquerel, the distinguished French physicist (in February, 1896), during his experimental research, accidentally discovered that a compound of Uranium (*i.e.* Uranium-Potassium Sulphate) affected a photographic plate in the dark through a copper sheet without any lens or "lighting" being used, as in the general case. From what was known of Uranium, it had been considered that the "X" rays* (discovered by Röntgen) always accompanied fluorescence. Later it was found that this result of "fogging" the photographic plate had nothing whatsoever to do with fluorescence, but was a specific property of the element Uranium, whether fluorescent or not, caused by *invisible* "rays" which could pass through a copper plate, black paper, and thin glass, etc.

Certain other metals were known, which, after being exposed to the sunlight, would then continue to radiate off "rays" for some time, and which could also affect a photographic plate through paper. Fluorescent substances, such as Calcium Sulphide and Hexagonal Blende, were noted by Becquerel, Arnold, Troost and others to do this. This property has since been found to be due to ultra-violet rays, which can penetrate substances opaque to ordinary light, on account of their very short wavelengths.

Now Uranium, it was observed, *always* possessed this power of affecting a photographic plate through paper, without ever having been excited by the energy of the

sunlight, and in fact Uranium Salts which had been kept in the dark for years, and which had never been exposed to the light, were found equally as "active" as those which had.

Consequently the great new scientific fact then (as mentioned above), which Becquerel recognised, was that "the metal Uranium possessed the new and hitherto unknown property of continually and spontaneously "emitting" from within invisible active rays, which could penetrate substances opaque to ordinary light," in other words it was "radio-active."

It was this great discovery which paved the way, and, as we know, finally led to the discovery of "Radium" a few years later. The joint discoverers of Radium were (in 1903) the prominent scientific investigators, Professor Pierre Curie (a Frenchman, 1859-1905) and his wife, Madame Marie Curie* (a Pole, 1867-?), and curious to relate, their wonderful work was patiently carried out in poverty, and under great difficulties.

The electrical experiments which had been carried out by these two famous scientists had led them to believe that there must be in "Pitch-blende" some element far more radio-active than Uranium, which up to the time had not been discovered by chemical analysis; and on the hopes of isolating "this element" they bent all their investigations.

Here it is deeply interesting to note that for the first time the scientific world had such a great pioneer in a woman, Madame Curie, and it is to Madame Curie that the chief success of the discovery of radio-activity is due.

In 1910 Radium was first prepared in a pure basic condition by Madame Curie, assisted by M. André Debierne, and as the pure metal by Madame Curie in 1911, this was accomplished by electrolysing a solution of a radium salt (*i.e.* pure Radium Chloride), using a Mercury Cathode and Platinum Iridium Anode. The original agent from which they obtained their source of Radium was "Barium," which they had already extracted from several tons of

Radium, this metallic chemical element from Pitch-blende, was actually discovered by P. and M. Curie and G. Bémont in 1898 ("Encyclopædia Britannica").

Bavarian Pitch-blende, while the Austrian Government had kindly presented the Curies with one ton of Uranium residues from the State manufactory at Joachimsthal, Bohemia.

Pitch-blende residues are obtained from Bavaria, Rezbaria in Hungary, Cornwall, and other places, the Trenwith mine at St. Ives, Cornwall, being the source in this country. Radium is said to be present in the proportion of 1 part to every 5 million parts of the best Pitch-blende, other statements say 1 to 8 or 10 million parts of Pitch-blende. Radium is also present in a minor degree in the minerals:—

Autunite, from Portugal and China, contains much Uranium.

Carnotite, from America and Australia, contains Uranium and Vanadium.

Chalcolite or Torbernite, from Redruth, Cornwall, contains Uranium and Pitch-blende.

Coal, from Alabama.

Radio-active substances are also found in the following radiferous minerals: Alvite, Arrhenite, Broggerite, Clèveite, Euxenite, Fergusonite, Orangite, Samarskite, Sipilite, Thorite, Uranite, Uranium ore, Wiikite (yellow and black), Zircon (shown by Strutt), and the mica of the rocks has been shown radio-actively sensitive (see “Pleochroic Haloes,” by Professor Joly).

Wiikite,* mentioned above, containing Radium, Uranium, 2 % Scandium, was discovered by Sir William Crookes, and much great work upon it and the others has been carried out by him. He has obtained photographs produced by the “emanations” of the above substances, by placing them upon a photographic plate in the darkness for 19 days. He has called these photographs “autoradiographs,” since they show the distribution of the radio-active constituents in the minerals, and he states further that these minerals owe their radio-activity to the

* This rare mineral is found at Impilaka Lake, Ladoga, Finland. The following are also of interest: (1) Thorianite, a new radio-active substance found in a river bed in Ceylon. (2) Menothorium, a new radium substitute, found in Golden (Colorado) by Dr. R. N. Moore. (3) Petroleum, from certain deep wells, has shown radio-activity (H. P. S.). (4) Water, for radio-active waters, see page 37.

RADIUM

presence of Uranium and Radium. (For photo, etc., see page 1155, Volume 2, "Harmsworth's Popular Science.")

While the sea has been estimated to contain 20,000 tons of Radium, it is said also Radium can be got from everywhere; it is in the sun, in the earth, and in the air. In fact the earth is stated to be heated by the radio-activity in it, the radio-activity of the soil being due to small quantities of Radium, Thorium, and Actinium emanations. The radio-activity of the air is said to be due to these emanations escaping from the soil into it, and it has been calculated that there must be 600 tons of Radium in the superficial soil, to keep up the supply of radio-active matter in the atmosphere. ("Harmsworth's Popular Science," Volume 2, page 1155.)

Let us now turn from this brief survey of the "origin" of Radium to its scientific properties and characters.

SCIENTIFIC PROPERTIES AND CHARACTERS OF RADIUM

Radium and the Photographic Plate.—Radium, like Uranium, will "fog" or blacken a photographic plate, the difference being that whereas Uranium takes some hours to accomplish this, Radium can produce the same effect in a few seconds. From this, of course, it was deduced that the radio-activity of Radium was very considerably greater than that of Uranium; in fact the energy of Radium may be estimated roughly to be about two million times that of Uranium.

The Atomic Weight of Radium.—Madame Curie, taking Chlorine (Cl) as 35.4 and Silver (Ag) 107.8, estimated the Atomic Weight of the element as 225.0. This result therefore should place Radium below Barium, and on the same line as Uranium and Thorium in the Mendeléef series. Doubt led to a discussion on this subject. Ramsay suggested 240 or more as most likely. However, T. E. Thorpe, in his experiments on pure Radium Chloride from Pitch-blende residues, determined the Atomic Weight as 226.7. Other work has been, and is, we believe, being carried out, with a view to an accurate international determination, while Madame Curie, in a recent re-determination,

using 0.4 gram of pure Radium Chloride, estimated the Atomic Weight as 226.2.

The still more recent table of Atomic Weights (which is given in full, Plate 0, pages 157 to 159) gives the Atomic Weight of Radium as 226.4, which is probably the most accurate determination up to date.

The Spinthariscopes, named after *σπινθαρίς*, the Greek word for a scintillation, and *σκοπέω*, "examine." (Scintillation, der.: "scintilla," the Latin for a spark.)—One of the greatest properties of Radium is demonstrated by its "Scintillations" in a spinthariscopes. For those unacquainted with a spinthariscopes, we may state that it is an instrument which has been devised* to show the scintillations. It consists of a small cylindrical box or tube, having at one end an adjustable magnifying eyepiece. Placed at the other end of the tube is a piece of phosphorescent zinc-sulphide screen, a little above this is arranged a small "arm," on which is mounted a minute particle of the Radium salt or other radio-active element for inspection. Radium, as we know, is continually radiating with great velocity what are termed its "a" or "alpha" rays, and these rays upon striking the zinc-sulphide screen produce *luminous* scintillations, which twinkle and look like little greenish-white starlike sparks or explosions. Hence radio-active substances emitting "alpha" rays can be easily recognised by the spinthariscopes, with which we will deal more fully later in the "New Activity." (See page 68.)

The spinthariscopes incidentally possesses one most important and valuable feature, namely, that by it individual "a" particles can be made visible, since each scintillation shown by it corresponds to a *single* "a" particle. Otherwise it would take a portion of matter of a billion "a" particles to be hardly visible under the microscope, while more than a trillion would be required to be detected by a delicate balance. So in the spinthariscopes we have an instrument for showing individual "a" particles which, as we shall prove later, are really "alpha Helium atoms." The number of "a" particles emitted

in a spinthariscopes have actually been counted, and they have also since been counted by a photographic method by Kinoshita. (Refs.: "Harmsworth's Popular Science"; "Beyond the Atom," by J. Cox; "Encyclopædia Britannica.")

The Electroscope.—Radium also possesses the faculty of *discharging a charged "electroscope."* A gold-leaf electroscope is *charged* either positively or negatively, and upon bringing a known weight, such as 5 milligrams of Radium Bromide in a metal box, within the vicinity of the electroscope (even though the box may be of zinc or iron an inch or more in thickness) the already diverged leaves are observed to fall. Consequently, knowing the weight of Radium, the distance between it and the electroscope, and the time taken for the leaves to drop, the purity of the sample in question can be estimated. Soddy states that $\frac{1}{3,000,000,000}$ (one three-thousand millionth) of a grain of Radium can be easily detected by an electroscope.

Electrified bodies are discharged* by all the Radium rays, the "a," the "b," and the "g," and a sample of Radium also, when brought close or parallel to the discharge rods of an induction coil, is able to affect and in some cases check the discharge. (Watson's "Text Book of Physics," 1911.)

The electroscope also will be explained more fully in the "New Activity." (See page 76.)

Radium and Glass.—One of the chemical properties of Radium, as we shall see later, is its power of colouring glass, and the "radium emanation," upon being compressed into a capillary tube, and changing into its various products, considerably darkens the glass walls of the tube. ("Pleochroic Haloes," by Professor Joly.)

Also when a particle of Radium is contained in a sealed glass tube and kept, it has constantly been observed that the glass tube will become cut by cracks, or sometimes break spontaneously. The reason is said to be owing to the tremendous difference in potential caused by the charged "alpha" particles being confined ~~for the inner~~

* Due to "ionisation," see later note on pages 16, 19, 24.

sides of the tube, which incidentally must total thousands of volts. To overcome this accumulation of the “a” particles, Mackenzie Davidson suggests sealing a piece of platinum wire into the tube to act as a conductor. Another theory, to account for the Radium breaking the tubes, suggests that it is due to the continual bombardment of the “alpha” rays upon the glass.

The action of the “New Activity” upon glass is an important fact also referred to later. (See page 71.)

Radium, its Life and Luminosity.—A newly prepared Radium salt is estimated to reach its zenith in about twenty-one days, and is then said to last indefinitely, but is stated to fall to $\frac{1}{2}$ value in 2000 years (J. Cox). The average life of the Radium atom is 2500 years (Soddy). Rutherford states 2600 years.

The luminosity of Radium can be seen in the dark, but one should not judge its value by this, as in a certain proportion with “Barium” it is even more brilliant. Radium Bromide ($\text{RaBr}_2=386.24$ Atomic Weight) in the pure state will light up a screen through several pennies or copper coins, and it will also make both Willemite (Zinc-silicate) and Barium Platino-cyanide fluoresce. (N.B. *re* rays later: Zinc Sulphide is very much more sensitive to “a” than it is to “b” rays, but Willemite and Barium Platino-cyanide are much more affected by “b” than “a” rays.) While Radium, as well as exciting phosphorescence, is itself phosphorescent, enabling it to be photographed by its own light, and again a tube of Radium wrapped up in black paper will light up a diamond placed near.

Radium and the Skin.—Radium will burn the skin if brought within close proximity, though curiously no sensation is noticed at the time of application, but later. This was discovered by M. Becquerel, who, on his way from Paris to the Royal Institution, London, in 1901, carried with him in his waistcoat pocket a few milligrams of Radium, which made a deep abscess in his side, taking fourteen days to appear—this has been termed the “Becquerel Burn,” and it is owing to the burning nature of the Radium rays that it has been tried so much in therapeutics. (See its medical uses, page 34.)

Chemical Properties.—Giesel found that Radium decomposed water into its constituents Hydrogen and Oxygen, Hydrogen being 5.1 per cent. in excess. Hydrochloric acid is decomposed by the Radium emanation, Chlorine being liberated; Carbon dioxide and Ammonia are also decomposed (Ramsay). While Demarçay states that Oxygen is converted into Ozone.

The Radium emanation rots cloth (Blythswood), while port wine stains on cloth are removed by it (Hartigan). Glass in contamination with Radium is turned to a violet colour; salt is turned blue; and yellow phosphorus is converted into the red variety (Sudborough); and Giesel found that radium salts (such as the pure Bromide) give a beautiful carmine colour in the "Bunsen" flame; Barium imparts a green. The flame spectrum of Radium shows two broad bright bands in the orange red; there is also a line in the blue green, and two weak lines in the violet. ("Encyclopædia Britannica.")

Mercury can be converted into the yellow oxide by Radium, and corrosive sublimate is converted into "Calomel" by it.

Radium also gives a sensation of light to the human eye, even through closed eyelids, if brought close enough.

Radium is divalent, and the element in its free basic condition very rapidly oxidises, so it is on account of this that the salt pure Radium Bromide ($\text{RaBr}_2 = 386.24$ Atomic Weight) is the salt with which most work has been accomplished. Radium Bromide occurs in hard crystalline particles of a yellowish nature, and when supplied is contained in hermetically sealed glass tubes. Its melting point is 728°C . Radium Bromide possesses a smell like ozone, though curiously its solution does not.

Pure Radium (226.4 Atomic Weight) is now treated as metallic Radium, it fuses at approximately 700° , decomposes water energetically, and upon being exposed to the air at this temperature readily blackens. Metallic Radium is volatile, and much more so than Barium.

The Oxide of Radium, namely RaO , can be easily converted into Radium per-Oxide (RaO_2) at red heat. Radium Oxide is soluble in water, while Radium Carbonate

is insoluble. Radium Carbonate should be decomposed at a red heat with some difficulty.

Radium has so far been found to *always* accompany the Uranium compound. Soddy states that in all the radio-active minerals there is always approximately 3,000,000 times as much Uranium as Radium. Another statement says there are about 333.3 milligrams of Radium to every ton of Uranium, and Rutherford and Boltwood found 3.4 parts of Radium, by weight, are present in 10,000,000, parts of Uranium.

The analysis of Pitch-blende showed that the acid group precipitate (containing Bismuth with Polonium) possessed considerable radio-activity, but that the alkaline earth group possessed the greatest activity, and it has now been conclusively proved that the “Spectrum of Radium” resembles those of the alkaline earths.

Curie and Laborde discovered that Radium also had the curious property of always being of a slightly higher temperature than its surroundings (*i.e.* it keeps 2.7° F. above the air); the reason of this “heat evolution” being due to the tremendous energy which the “atoms” cause by their spontaneously breaking up into the “rays.” A given weight of Radium will melt its equivalent weight of ice in every hour, while Soddy states that in the same time the amount of heat evolved by a quantity of Radium is practically about as much as would be required to raise an equal mass of water from the freezing to the boiling point. Schweidler and Hess, in estimating the “heat emitted” by Radium, say that $\frac{1}{2}$ gram of Radium gives 118 gram-calories per gram-hour. Another determination, probably more recent, of the “heat emission” of Radium, states that 1 gram of Radium emits heat at the rate of 132 gram-calories per hour, which consequently would be sufficient to melt 1.6 times its own weight of ice per hour (J. Cox).

The action of “The New Activity” upon ice is an important point dealt with later. (See page 78.)

Radium has been called the “Genius of all elements,” no doubt on account of its “producing light and heat continuously,” and lasting practically indefinitely.

Radium and its Evolution of Energy.—One of the

greatest and most unfathomable properties of Radium is demonstrated by its gigantic output of "energy" in the form of *heat*. The "Alchemist's dream" of the bygone ages, or the transmutation of metals, by which they had hoped to be able at the expense of tremendous heat and energy to rearrange the atomic structure, and thus be able to convert the baser metals (such as lead) into the nobler metals (such as gold) comes nearer to reality than ever in the present decade.

But from the discovery of "radio-activity" the modern scientist has learnt that if the "transmutation of metals" takes place, as it probably does, that it is *vice-versa*, and that it is the nobler metals such as Uranium that in their lives and changes become finally converted into the baser metals such as lead; and it is during this great both physical and chemical change that vast and most valuable stores of atomic energy are slowly released in the shape of heat.

The lives and various stages of the different radio-active bodies are dealt with later (page 29), but the following estimations will give some idea as to the enormous and almost inconceivable "energy" evolved by Radium.

Radium, it has been stated, can produce from first to last 250,000 times as much energy as is produced by the combustion of an equal weight of coal. ("Harmsworth's Popular Science.")

Soddy shows us a stupendous comparison, when he states that in its complete change 1 gram of Radium evolves as much energy as is given by $\frac{1}{4}$ ton of coal when combining with the Oxygen and burning in the air. (Ref.: "Matter and Energy," by F. Soddy.)

C. E. S. Philips says that 1 ton of Radium is equal to 1,500,000 tons of coal in energy, and that 1 gram of Radium in its lifetime gives off roughly 3000 horse-power. (Ref.: "Cancer Hospital Lecture," December 10, 1913.) And it is also estimated that 1 gram would "emit" a quantity of heat of 118 calories per hour, in addition to a certain amount of energy being "continuously emitted" in the form of rays (Watson) (ref. also page 15). While yet another determination gives us the energy of the

"Radium Emanation" in terms of horse-power, by stating that 1 pound of the Emanation would at its maximum intensity radiate "energy" at the rate of about 10,000 horse-power ("Beyond the Atom," by J. Cox) (see "Emanation," p. 14). So we see that one of the many great problems which yet remain to be mastered by the future chemist lies in the successful concentration of this enormous energy from "radio-activity," and in its conversion into terms of "work" for practical purposes.

The Radium Emanation.—Originally called "Exradio" (Ramsay), now known as "Niton" (Nt. 222.4 Atomic Weight). Its unit for purposes of measurement is to be called the "Curie," after Madame Curie.

Radium, as well as "emitting rays," also evolves "*emanations*," which are self-luminous and in nature gaseous, being allied to the group of inert monatomic gases like Argon and Helium.

These gaseous emanations, or the "Radium emanation," form an exceptionally dense gas, in fact denser than Mercury.

The Radium emanation is said to have no chemical activity—it can be condensed at low temperatures by freezing with "liquid air." Rutherford and Soddy showed that under normal conditions the temperature of condensation of the "Radium emanation" (mixed with air) was -150°C. (Ref.: "Encyclopædia Britannica.")

The emanation boils at -71°C. , and 211° absolute is its critical temperature. It follows Boyle's law, and Ramsay originally stated it had a density of 100, and molecular weight 200, probably the same as its Atomic Weight, which was later determined by him as 222.5.

The gas is liberated without any appreciable loss in weight of the original matter, and it is stated that the amount of emanation from 1 gram of pure Radium would be .82 cubic millimetres (J. Cox). (For Soddy's determination, which differs slightly, see page 14.)

Ramsay and Soddy observed it gave "*Helium spectrum*" upon keeping, and pure Radium emanation in a spectrum tube gives the characteristic spectrum of bright lines.

After $3\frac{1}{2}$ days the amount of luminous gas was found to have been reduced to $\frac{1}{2}$ its original size, while after 30 days it was only the smallest pin point; other more recent work states that the average life of the Radium emanation is 5.55 days, and that its activity decays to $\frac{1}{2}$ value in less than 4 days.

By dissolving the Radium salt in water the emanation is set free. Water is decomposed by the Radium emanation, Hydrogen being 3 per cent. in excess. It will also make the gases recombine.

The Radium emanation causes Willemite to glow brilliantly in the dark, and when acting upon a solution of copper causes some of the copper to be converted into "Lithium." The Radium emanation is partially soluble in water, and can be absorbed by cocoanut-charcoal at normal temperature and pressure, while upon heating the charcoal the emanation is liberated and can consequently be concentrated.

The Radium Emanation is "*radio-active*," but emits "a" rays only. Radium, it has been found, in changing into the emanation gives out "a" particles, and the emanation in its turn, as just mentioned, gives off "a" particles as it passes into the "active deposit."

The "active deposit" is stated to give all the 3 types of radiations (J. Cox). In accounting for this, one theory states that the various rays are produced by the gaseous emanations disintegrating in definite phases.

"Niton," or the radio-active emanation, is extremely radio-active, and is stated to be weight for weight about 100,000 times as radio-active as Radium.* The Radium emanation, and in fact all radio-active emanations, possess the property of giving photographic and phosphorescent effects when they are strong enough, but it has been found that these do *not* † last. J. Cox states that other solids which have come in contact with the emanations become themselves radio-active. These solids behave as if the emanations had deposited upon them "active matter." Rutherford proved ‡ that this effect is not due to radiations,

* Ref.: "Encyclopædia Britannica."

† Of great importance, see page 74.

‡ Ref.: "Beyond the Atom," J. Cox, page 64.

but to the actual contact with the emanations themselves. The "active deposit" possesses definite chemical properties; for instance, it is not soluble in water or Nitric acid, but it is soluble in Sulphuric and Hydrochloric acids.

The amount of gaseous emanation obtained from 1 gram of pure Radium occupies a volume measured at normal temperature and pressure of only 0.6 of a cubic millimetre, *i.e.* approximately the size of an ordinary pin's head. ("Matter and Energy," by F. Soddy.)

A few interesting facts about the Radium emanation are quoted from "Harmsworth's Popular Science." One states that it has been estimated that a tiny bubble of the Radium emanation, say $\frac{1}{30}$ (*i.e.* one-thirtieth) of a pin's head in volume, put in a globe dusted over with Zinc-sulphide would shine thenceforth with a soft white light, like a fairy lantern.

A second fact deals with the "heat evolved" by the Radium emanation, which, like that evolved by the metal Radium, is tremendous—it is said that a thimbleful of the Radium emanation would contain approximately 7 million calories of heat, *i.e.* sufficient heat to raise 15,000 pounds of water one degree.

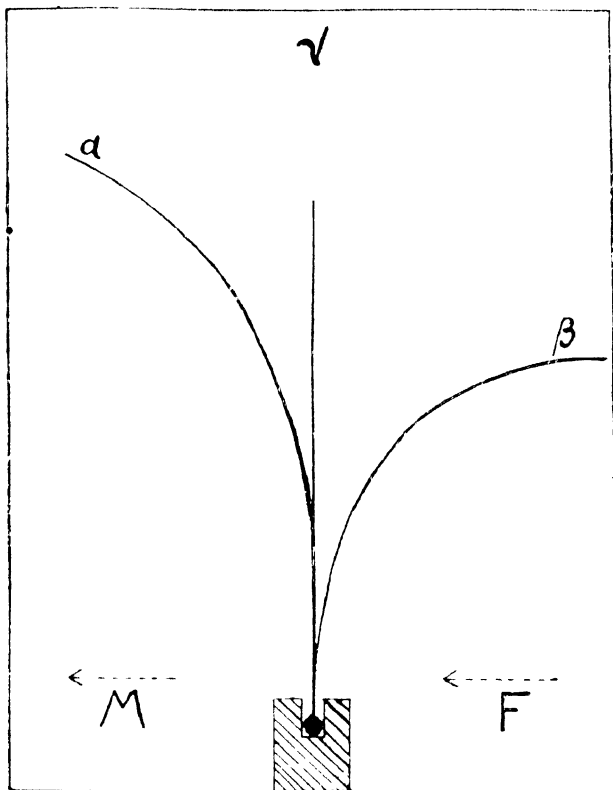
The quantity of heat evolved by the Radium emanation is, weight for weight, about 1 million times greater than that resulting from any other known chemical reaction. In fact, no receptacle could hold, say, 1 pint of the Radium emanation, for the amount of heat it would generate would spontaneously melt and volatilise any substance known; platinum, for instance, would run like wax.

Whereas in "energy," 1 pound of the "Radium emanation" corresponds to 10,000 horse-power, already referred to, page 12.

Before concluding these notes on the Radium emanation, it would be well to point out how wonderful it is that such careful and accurate estimations have been arrived at by those scientists responsible, when we bear in mind that there never has been more than the minutest of quantities at their disposal—the infinitesimal amount alone, resulting from so much as 1 gram of Radium, has already been purposely pointed out.

PLATE No. 2.

FIGURE SHOWING THE DEVIATION OF THE RADIUM RAYS IN A MAGNETIC FIELD.



Drawing by F. A. Hotblack.

(NOTE.— The above figure shows a minute particle of Radium salt recessed in a narrow lead tube, or suitably made lead box, so that the rays to be observed can only escape out, and act in the one known direction.)

The above rays are seen in a magnetic or electric field, which is acting at right angles to the rays; *i.e.* in the direction M, F.

The DEVIATION of the RAYS being, as the figure shows, viz. :— that the “α” (alpha) rays are slightly deviable.

“β” (beta) rays are deviable; they are about 1,000 times more so than the “α,” and are in the opposite direction.

“γ” (gamma) rays are non-deviable.

(Ref. page 15, line 14)

The Emanation given by the "New Activity" is of great importance, and is dealt with later. (See page 88.)

Let us now turn from the enumeration of some of the properties of Radium to the "rays" emitted by it.

The Radium Rays.—The Radium rays are of at least three different kinds, and were named by Rutherford the " α " (alpha), the " β " (beta), and the " γ " (gamma).

The " α " (alpha) Rays.—The " α " (alpha) ray, namely, to which 95 to 99 per cent. of the energy evolved from radio-active substances is due (Soddy), has the following properties: The " α " rays are non-penetrating, and are slightly deviable in a strong magnetic field. (Note, their deviation is $\frac{1}{1000}$ that of the " β " ray, and their direction opposite, see chart accompanying, Plate 2.)

The " α " ray of Radium is said to be constituted of electrically positively charged *atoms*; it carries two atomic charges of positive electricity (*i.e.* it is a divalent ion) and has a mass approximately 4 times that of the Hydrogen atom; * a more recent work states 3.8 times.

The " α " ray travels at the enormous velocity of 12,000 miles per second, which is about $\frac{1}{16}$ of the velocity of light itself,† though other and probably earlier statements say it can even attain so great a speed as 18,600 or 20,000 miles per second. This velocity, however, decreases rapidly upon the " α " particles travelling through matter.

The " α " ray was originally stated to become a "Helium atom" after travelling at this high velocity—it has since been conclusively proved to be such an atom—and we know also that Helium is ultimately produced by Radium. Rutherford, in an experiment, detected "Helium" *outside* a sealed glass tube containing Radium in vacuo, the glass tube, of course, being thin enough to permit the "alpha" ray passing through.

The "alpha" rays are absorbed by glass, considerably by mica, completely by a layer of aluminium .04 millimetres thick, or by 5 to 7 centimetres of air, and even by a sheet of notepaper. Very thin glass, however, will permit them to pass—as used in Madame Curie's standard sample.

* The same as the atomic mass of the Helium atom (Soddy).

† Velocity of light = 186,000 miles per second.

The powers of penetration of the "a" rays are very feeble compared with those of the "b" and "g" rays, dealt with later; in fact, practically anything is able to stop the "a" rays. Bragg observed that the "stopping power" of any substance is proportional to the square root of its atomic weight. Tin, however, being an exception to this rule, both for the "a" and the "b" rays, it has about the same "stopping power" as aluminium in the case of the "alpha" ray. Bragg—in the Bragg curve—from other experiments with "alpha" rays, also states that the "a" ray behaves much the same in the solid as in the gas.

The properties of the "a" rays are similar to some of those of Radium—they possess the properties of "ionisation,"* and thus discharging electrified bodies, they excite phosphorescence in certain substances, and are capable of giving fluorescent and photographic effects; and Rutherford found that after reducing the speed of the "a" particles by 40 per cent. that the "ionising power" was lost, and with it went the fluorescent and photographic properties.

It is the "a" ray (the Helium atom) which becomes visible upon striking the zinc-sulphide screen in the spinthariscopes.

The number of "a" particles being continuously emitted per second from a quantity of Radium is tremendous. Soddy states that 1 milligram of Radium emits 136 million "a" particles per second. Another authority states that 1 grain of Radium shoots forth about 10 thousand million "alpha" particles per second ("Harmsworth's Popular Science," page 1271), and it says further that the "alpha Helium atom" in a spinthariscopes is 40,000 times swifter than the fastest rifle bullet, and it splinters and electrifies one hundred thousand molecules of air, the path of the "alpha" particles being always strewn with broken and electrified air molecules.

All "alpha" particles from any radio-active element have the same mass, and differ only in the initial velocity of expulsion, whether expelled from Radium

* "Ionisation," see note on pages 19, 24.

emanation, Uranium, or Thorium, etc. (Martindale and Westcott.)

Geologists now state that certain "Pleochroic Haloes," which have been found in some rocks, are probably due to the results of "alpha radiations." (Referred to later, on page 39.)

In medicine, the "a." rays have been experimented with and tried upon living cells, but the exact action of the "a" rays was uncertain. However, Radium probably has the effect of coagulating the proteids of the living body, since upon exposing a solution of globulin (a proteid found in the living tissues) to "alpha" rays it becomes instantly congealed. ("Harmsworth's Popular Science." See also pages, 35, 40-41.)

When bearing in mind the marvellous and absolutely original properties of the "alpha" rays, of which only a few points are given here, it is not at all extraordinary that Professor Joly has so wisely stated that "the advent of the 'alpha' ray into science has altered fundamentally our conception of matter."

Another eminent British scientist has drawn the comparison between the pace of the snail crawling along and of the speed attained by a fast aeroplane; but even the velocity of the latter, he points out, is a mere hovering when pitted against the flight of the "alpha" rays from Radium, which, he remarks, if they were unhindered by obstruction in their passage, would cross the globe in the twinkling of an eye. (Sir Oliver Lodge, *Strand Magazine*, December, 1917.)

And now having dealt with the "alpha" ray, we will pass on to the second or "beta" ray of Radium.

The "b" (beta) Rays.—The "b" rays are deviable in a magnetic field, and are more penetrating than the "a" rays. The "b" ray is said to be 1000 times smaller than the "a" ray, and its power of penetration varies with its velocity. Soddy states that the penetrating power of the "b" rays is somewhat less than that of the average "X" rays.* (Ref.: "Matter and Energy.")

The "b" rays, though smaller than the "alpha"

* "X" rays dealt with, pages 19, 20.

atoms, are claimed to be 100 times *more* penetrating than the "a" rays. All "b" rays are stopped by 1 centimetre thick of lead, and it has been said they will penetrate a layer of aluminium $\frac{1}{5}$ (one-fifth) of an inch thick (H. P. S.), though Rutherford states that 3 or 4 millimetres of aluminium or an inch of cardboard are sufficient to absorb all "b" rays, yet "g" rays, on the contrary, are able to pass through 20 centimetres of lead, or even through 2 feet of iron.

The "b" rays correspond in many properties to the "Cathode rays" * in a Crookes's tube, though they are some 10 times more rapid than the "Cathode rays." (Hon. R. J. Strutt.)

Unlike the "a" rays, which are said to be atoms of matter, the "b" rays consist of electro-negatively charged electrons,† roughly 1000 times smaller than that of the Hydrogen atom. This does not mean weight, it refers to inertia. C. T. R. Wilson says, "the 'b' particle, which carries a negative charge only half as large as the positive charge of the 'alpha' particle, has a *mass less than the $\frac{1}{1700}$ part of the Hydrogen atom, etc.*" (Ref.: *Proceedings of the Royal Institution*, March 7, 1913.)

The velocity of the "b" rays has been calculated from their magnetic deflection, and they have been found to have a wide range of speeds, from approximately 60,000 miles per second even almost up to that of light itself. J. Cox states their velocity ranges from $\frac{2}{5}$ to $\frac{9}{10}$ the velocity of light, that is, from 74,400 to 167,400 miles per second. Another statement, which varies a little, says,

* The Cathode ray (Kathode, German) consists of a stream of negatively charged particles, minute compared with the smallest atom, but with a speed compared to that of Light itself. Velocity of Cathode particles are $\frac{1}{10}$ to $\frac{1}{2}$ that of Light, i.e. 6000 to 60,000 miles per second.

† **Electron.**—The Electron was discovered by Thomson. The most prolific source of electrons is in the Sun Spots. An electron is a disembodied charge without a material nucleus. It is a minute particle with an apparent mass, about $\frac{1}{1800}$ that of the Hydrogen atom, and bearing a negative charge, $e = 3.4 \times 10^{-10}$.

Mass of electron (a later determination says) is 1775 times less than mass of Hydrogen atom—the electron is one-hundred-thousand times smaller than the atom. (The above notes are from Thomson, J. Cox.)

the "b" rays are projected with a velocity of from 75,000 to fastest 170,000 miles per second. ("Harmsworth's Popular Science.")

The velocity of "b" rays emitted from the other different radio-active bodies has been found to vary correspondingly.

Many of the properties of the "b" rays are common to both the "a" and the "g" rays. The "b" rays possess the property of affecting photographic plates, discharging electrified bodies, and of exciting phosphorescence in certain substances, but the photographic action characteristic of Radium is mostly due to the "b" rays, on account of their penetration. (Watson's "Text Book of Physics," 1911.)

The "b" rays as well as the "a" rays "ionise" * the gas through which they traverse, rendering it a conductor of electricity, but "a" particles in this respect are much the more powerful. They leave a thin streak of "ionised" air, though "b" and even "g" rays will do it too. Incidentally every kind of radiating "ionises" air; "X" rays † are also quite effective in making it conductive.

The "b" rays do not give "scintillations" like the "a" rays, though some are claimed to have been seen from "b" rays (?). (*Nature*, February 8, 1906, page 341.)

In therapeutics and medicine most of the curative results are said to be due to these "b" rays, on account of their penetrating power, which enables them to pass through the glass tube containing the Radium salt, and thus reach the affected part; whereas "alpha" rays cannot do this.

And now having dealt with both the "a" and the "b" rays, we will next consider the third or "gamma" ray of Radium.

The "g" (gamma) Rays.—The "gamma" rays are exceedingly penetrating, and may be spoken of as non-electrified radiations; they are non-deviable, that is, they cannot be deflected by magnetic or electric fields.

* Ionisation, see page 24.

† "X" rays, see also pages 2, 17, 20.

The “g” rays in many ways resemble Röntgen’s “X” rays, and, like them, are probably not particles at all, but consist of thin pulses in the ether.

The “X” rays are believed to be ether disturbances of the nature of light; thus the “g” rays are identical in their nature with “X” rays and ordinary light, the difference being merely in wave-length. Their velocity is 3×10^{10} cm. per second.

The “g” rays *only and always accompany* the “b” rays, and have been found to be only produced when high-velocity “b” rays are present.

Rutherford states that the “gamma” rays accompanying the “beta” rays are identical with “X” rays, but are *more penetrating*; they have been found to be more penetrating than “X” rays from the “hardest” vacuum tube.

However, quoting Sir James Mackenzie Davidson, it would appear that: “One of the essential differences between the “X” rays and Radium is, that while the quality of the rays from a Crookes’s tube varies considerably from time to time, the output from the Radium is quite constant, and therefore—now referring to its medical uses, etc.—the duration of the application is the important factor.” (Ref.: “Vital effects of Radium,” Royal Institution *Proceedings*, Friday, February 2, 1912. Volume xx., page 302.)

The “g” rays are approximately 100 times more penetrating than the “b” rays; they are also said to be about 10,000 times more penetrating than the “alpha” rays. The “gamma” rays are able to go through anything, even lead, of which they will penetrate a plate nearly 3 inches thick, before being reduced to 1 per cent. of their original strength; they will penetrate also a block of aluminium 20 inches thick, and will even “ionise” a gas after passing through 30 centimetres of iron.

The “g” rays of Radium, like the “a” and the “b” rays, possess the property of affecting photographic plates, discharging electrified bodies, and exciting phosphorescence in certain substances. (H. P. S.)

But, in spite of their great penetrating properties, the diminutive size of the “gamma” rays prevents them being of much practical use for medical purposes.

The Delta Rays.—This new type of radiation, as described by Professor J. Thomson, need not be dealt with fully in this work.

In brief, it is "emitted" by numerous compounds, *i.e.*, by alloys of Potassium and Sodium, also from the sublimate got by heating Rubium in a vacuum tube.

This ray is said to consist of particles negatively charged, which travel at a velocity of approximately one-fiftieth ($\frac{1}{50}$) that of the "b" particle; hence it is only slightly penetrating, and can be actually stopped by air, even by as little as two millimetres (2 mm.) of air. (Ref.: Martindale and Westcott.)

GENERAL REMARKS

Radium, Quantity and Standards of.—The conclusion we draw from this short account of the origin and properties of Radium, is that perhaps the greatest difficulty of all has been in finding out *definite* scientific facts about an element so rare and so unique, and which exists in the whole world in such minute available quantities. And this fact alone demonstrates more clearly than ever the wonderful work carried out by Madame Curie, and later by other investigators.

Sir William Ramsay estimated the production of Radium could not exceed half an ounce in one year. Probably 6 or 7 grammes, or $\frac{1}{3}$ of an ounce, of Radium is approximately the total amount that has ever yet been prepared. Madame Curie is the possessor of the greater part of this.

Madame Curie has set up a "Radium Standard" of 21.99 milligrammes of "pure Radium Chloride." This sample, kept for purposes of record, etc., is contained in an hermetically sealed thin glass tube, and is deposited in Sèvres, Paris. The English standard consists of about the same quantity, and is maintained at Teddington.

Production of Radium.—There are, however, cheaper and more rapid methods of extracting Radium from Pitch-blende than those originally adopted by the Curies, who isolated it by means of successive fractional

crystallisations—a lengthy chemical process of “elimination.”

One of these more recent formulæ was published in the “Extra Pharmacopœia” (Martindale and Westcott, vol. i., 16th edition, 1915) entitled, *Radium, a Cheap and Rapid Method of Extraction from Pitch-blende*, which states:—

“100 kg. of finely ground Pitch-blende with 400 kg. concentrated crude Sulphuric acid are heated for several hours. The mixture is then boiled with from 10 to 20 times the quantity of water, left to stand, decanted, and the residue washed with water and the liquid filtered off. The dry residue (about 40–50 kg.) is heated with 140 kg. of commercial caustic soda in an iron crucible till a uniform mass is obtained, *i.e.* in about 1 to 2 hours. This is afterwards boiled several times with about 1000 litres of water, left to stand, decanted, and filtered. The moist residue is then boiled with 5 kg. of 20 per cent. sulphuric acid solution, filtered, and washed with water. Raw sulphates of Radium, to the amount of 0.5 kg., are thus obtained. These can be quickly converted to chlorides by melting with alkaline carbonates, washing thoroughly with water, and dissolving the residue in pure hydrochloric acid.” (Ref.: P. J. ii. 10453.)

So it will be seen that it is by this or other similar methods that Radium salts can be more or less cheaply and easily produced as a commercial success.

In addition to the radio-active properties of Radium which we have discussed there are “other radio-active elements,” though of a different and less powerful nature. It has naturally been suggested that the “Dickinson radio-active substance” is either one of these or some other unknown radio-active element; or, again, some compound which has been treated successfully (*i.e.* rendering it “active”) by one of the known activities.

Before concluding this chapter on “Radium” it would be as well then to mention the other “radio-active elements,” and thus we shall be able to see later on (see page 91) whether the “Dickinson radio-activity” is probably one of these known activities, or not.

OTHER RADIO-ACTIVE ELEMENTS

The following are also "radio-active": Thorium, Uranium, Polonium, and Actinium, and their relative position to Radium can be seen from the following table:—

PLATE 3.

RAYS.

	Non-penetrating	More penetrating	Very penetrating	Emanations	Whether able to impart radio-activity to surrounding bodies.
Uranium	Yes	Yes	Yes	No	No
Thorium	Yes	Yes	Yes	Yes	Yes
Radium	Yes	Yes	Yes	Yes	Yes
Polonium	Yes	No	No	No	No
Actinium	?	Yes	?	Yes	Yes

(Reproduced from "The Extra Pharmacopœia," Martindale and Westcott, 1908, page 676.)

Only just the shortest of remarks need be made about the above, as to deal fully with each would be a work in itself, and one which does not concern us here.

Uranium.—Uranium has an atomic weight 238·5; the pure metal is hard but fairly malleable, and is of a whitish colour and lustre, like nickel or iron. Uranium was first discovered as an element by Klaproth, who isolated the metallic yellow oxide from Pitch-blende in 1789.

Uranium is one of the constituents of Pitch-blende, and is an *ancestor* of Radium; hence in every mineral where Radium is found Uranium is always contained, there being, as we know, a definitely greater proportion of Uranium to every part of Radium (refer back, top of page 10). In Western Colorado, Uranium salts have been found as minute particles in sandstone, having a lemon-yellowish colour—probably the oxide.

Uranium, like Thorium, is one of the parent radio-active bodies, and nothing whatsoever is known respecting the origin of Uranium. (Joly.)

Metallic Uranium as well as its salts are distinguished on account of their luminosity, giving a glow of exceedingly bright yellowish-white colour. By even shaking these in a bottle the effect is so luminous as to be easily observed throughout a large room.

One of its important features is its ability to produce a photograph (*i.e.* a shadowgraph) *through a piece of wood*. This is accomplished in about 7 hours, by placing a coin on a photographic plate, and above the latter is placed a wooden slide about $\frac{5}{8}$ (five-eighths) of an inch in thickness, the Uranium crystals next being placed upon the wood. The photographic result obtained is a clear demonstration of its “activity.”

We must bear in mind, as already outlined in the beginning of the book, what a great fundamental part in “radio-activity” Uranium plays, when we remember that it was the photographic effects of Uranium which opened Becquerel’s eyes and showed him its “radio-active” properties.

Uranium normally “emits” both “a” (alpha) and “b” (beta) rays, which rays can discharge both positive (+) and negative (—) electricity (*i.e.* “ionising” the gas* through which they pass, rendering it conductive).

* Ionisation, notes on:—

1. The air or gas in the neighbourhood of an “ionising” agent becomes ionised, that is, it is rendered capable of conducting electricity.

2. “Ionisation” is brought about by the liberation of a negatively charged electron from an atom, caused by the striking of the atom by an “alpha” or “beta” ray, thus leaving the atom with an excess of positive electricity. The liberated negatively charged electron becoming attached to another atomic system, causes it to have an excess of negative electricity, we thus have negatively and positively charged atoms or “ions.” (W. W. B.)

3. The “ionisation” effected anywhere along the path of a ray is inversely proportional to the velocity of the ray at that point. (“Pleochroic Haloes,” J. Joly.)

4. Reason why Radium discharges an Electroscope.—This occurs whether the charge on the leaves be + or —. All the three types of radiation from Radium have the effect of “ionising” air in the electroscope, breaking the molecules into constituent atoms, each of which is electrically charged + or —. These charged atoms collide with the charged “gold-leaves,” and such as are of opposite sign to the charge on the leaves neutralize a corresponding amount of electricity on the leaves. (M. and W., B. M. J., Jan., 1909, 1465.)

Two "a" particles are expelled at each atomic disintegration of Uranium. The element has this distinctive feature amongst known substances expelling "a" rays. The two "a" particles are expelled at slightly different initial velocities—they are thought to be driven off successively. In other words, Uranium is really two bodies and not a single element. (M. & W.)

Crookes found that the "a" rays of Uranium give very little photographic effect, which is almost entirely due to its "b" rays, whilst the "a" rays are much the best for "ionisation." (J. Cox.)

These "a" particles of Uranium are said to fly at 9600 miles per second. (H. P. S.)

Uranium, though its evolution of energy is ever so much slower, is said to have 14 per cent. more energy than Radium. (H. P. S.)

The period of the average life of Uranium has been stated by Soddy as 3,000,000 times that of Radium, or 7500 million years. This has been deduced from the fact that there are 3,000,000 parts of Uranium to every part of Radium, as well as from the fact that Uranium is changing many millions more times slowly than Radium, which accounts for its far longer life and its comparatively feeble radio-activity; and Uranium, in slowly undergoing these changes (referred to pages 29 to 32), is probably changing into "Ionium," and "Ionium" in time produces Radium, etc. (Ref.: "Matter and Energy," Chapter IX., Soddy.)

Helium again, which, as we know, is a resultant product given off at various stages from radio-active changes, has also been detected by Soddy to be formed from Uranium and Thorium, though in quantity only one-five-hundred-millionth of the mass of Uranium or Thorium per annum.

Thorium.—This element is a metal of the tin group resembling aluminium, and has atomic weight 232.4; and we are told that it changes broadly into Meso-thorium, this again changes into Radio-thorium, and this into Thorium X, etc. (it is both unnecessary and too lengthy to deal completely with all the Thorium changes here) (See Plate 4, page 163.)

Berzelius, the Swedish chemist, discovered Thoria in

1828 in the mineral now called Thorite. Thorium^o is one of the members of the “rare earths,” and is found in Euxenite, Orangite, Pyrochlore, but chiefly in Monazite Sand, from which it is now mostly obtained.

Thorium, like Uranium, is one of the parent radio-active bodies, and in the present state of knowledge nothing is known about its origin.

Madame Curie also discovered the “radio-activity” of Thorium, which shows its activity by emitting “a” rays, being approximately in value the same as those of Uranium.

Thorium, however, differs from Uranium in the fact that it gives, as Rutherford discovered, a radio-active gas or “emanation,” whereas Uranium does not. The activity of the “Thorium emanation” has been found to be short lived, and to decay to $\frac{1}{2}$ value in about 1 minute.

Meso-thorium emits “b” (and “g”) rays, which are fairly penetrating. Meso-thorium is obtained in the form of Meso-thorium Bromide, a white salt. Both Meso-thorium and Radio-thorium are capable of producing exceedingly marked effects on a zinc-sulphide screen (viz. in a spinthariscopes). When dealing with the “New Activity” later this fact should be borne in mind. (See page 55.)

Thorium is employed fairly extensively for commercial purposes. Its uses are dealt with later on (page 41).

Polonium.—Polonium has atomic weight 206.5.* It is interesting to note its proximity to that of lead.

Madame Curie also discovered this radio-active element in Pitch-blende, named Polonium, after Poland, her native land.

Marekvald later discovered “radio-tellurium,” which was then found to be identical with Polonium. (“Encyclopædia Britannica.”)

Polonium is also said to be identical with Radium F, and to be chemically analogous to Selenium and Tellurium. (The “Extra Pharmacopæia,” vol. i., 16th edition, 1915.)

Polonium emits practically only “a” (alpha) rays.

Polonium and Radium are said to be present in the

* The atomic weight of Polonium has also been estimated as 210.

proportion of 1 to 5000. And Soddy says that the quantity of Polonium found in a radium mineral is in the ratio of 1 milligram of Polonium to each 14 tons of Uranium.

Theorists assume that Polonium is transformed into Helium and Lead, 1 atom of Polonium to 1 of Lead+1 of Helium.

Polonium, though marked the least active of the Radium series, on account of its only giving "a" rays (see Table or Plate 3, page 23), is really intensely radio-active; in fact it has been estimated several times more radio-active than Radium; and it will so increase the conductivity of the air as to make an electric bell ring if brought near. (H. P. S.)

Very little appears to be known about Polonium.

In this country it is also found with the Radium from the Trenwith ore, which should be important, since the Cornish supply of Pitch-blende from the Trenwith mine, at St. Ives, is claimed to be richer in Radium than the Austrian. (M. & W.)

Actinium.—Discovered by Debierne. No doubt this is an element. From certain conditions its emanation is something like the "Thorium emanation," suggesting an Atomic Weight of approximately 220, though this has not yet been determined.

Irrespective of Debierne's discovery, Giesel independently noted Actinium and called it "Emanium," which he had separated with lanthanum and cerium from the minerals. (E. B.)

Actinium has never been obtained pure, and the exact process of producing it is not as yet known, but it is supposed to be a branch product of Uranium. It has, however, been isolated from Pitch-blende in the Ammonium-Hydrate group. According to Rutherford the immediate parent of Radium is present in this element from Pitch-blende; but as to the direct lineal descent, this has not yet been ascertained.

Actinium "emits" "b" rays; these rays are practically absorbed by Lead, but are, however, capable of passing through thin metal tin-foil.

So the curative results from Actinium must then in all probability be due to these "b" rays.

Actinium is stated to have a life of apparently about 30 years, while the “ Actinium emanation ” is said to be many thousand times stronger than the Radium emanation, on account of its more rapid period of decay.

Ionium.—Ionium, though not mentioned in the chart on page 23 (or Plate 3), possesses “ radio-activity,” and is therefore given a few lines here.

Like Polonium, very little appears to be known about Ionium.

In brief, Ionium is a product intermediate between Uranium and Radium. It was originally isolated from Carnotite (a Uranium mineral) by B. B. Boltwood in 1905, and was, according to him, a new radio-active *element*, which resembled Thorium, but which, however, gave no emanations.

Its radiation consists entirely of “ a ” rays at a low range.

More recent work states that Ionium is the *parent* of Radium, and that *it is changing rapidly into Radium*.

Ionium is further stated to have an atomic weight of 230, and to fall to $\frac{1}{2}$ value in about 200,000 years.

Soddy has estimated the average life of Ionium as probably at least 100 times longer than that of Radium. (Ref. : “ Matter and Energy.”)

By another recent method the period of Ionium has been suggested to be 200,000 years, and provided this is correct, then there should be 25 grams of Ionium per ton of Uranium in the minerals. (Ref. : *Proceedings* of the Royal Institution.)

Potassium and Rubidium.—Potassium and Rubidium,* like Ionium, are not dealt with in the chart on page 23 (or Plate 3), but since they possess “ radio-active ” properties, a few remarks about them here will not be out of place.

Potassium (referred to, page 94) and Rubidium are not in the generally accepted term “ radio-active elements,” such as Radium, Uranium, or Thorium.

The chemical properties of these two elements have

* *E.g.* Rb_2SO_4 is the Rubidium compound mostly experimented with.

been known for many years, and are to be found in all chemical works, but from their "radio-active" aspect, which concerns us, both Potassium and Rubidium are fully radio-active.

• They give electroscopic effects, and can affect photographic plates through black paper, both results being due to "b" rays.

They emit no "a" rays, give no scintillations on zinc-sulphide, give no emanations, nor are they capable of imparting "radio-activity" to other surrounding bodies.

Special interest is given to the "radio-activity" of Potassium, as it was one of those elements suggested to account for the Dickinson "New Activity." The reason why the "New Activity" is not a Potassium compound is explained in Chapter II. (See page 95.)

Certain other elements, such as Beryllium, Lanthanum, and Selenium,* etc., have also been claimed to be "radio-active" in some scientific works, but before passing on from the radio-active elements the author is able to say, upon the advice of one of our greatest authorities upon radio-activity, that the supposed "radio-activity" of these three latter elements is a myth, and that there are no other radio-active elements known except Uranium, Radium, Thorium, etc., and their derivatives, and Potassium and Rubidium.

It is of great importance to remember this when dealing with the "Dickinson newly-discovered radio-activity," described later.

The Transmutation of Uranium into Lead.—Explaining the changes of the different radio-active substances at their various stages of disintegration (referred to, pages 25, 29 to 32, etc., also see diagrams Nos. 5 and 4), we should note that the radio-active elements are in their lives undergoing a gradual succession of changes.

Now Uranium, which has been termed an *ancestor* of Radium, has an atomic weight 238; it throws off both "b" and "a" rays (*i.e.* Helium atoms), and has been calculated to become, in 7500 million years, after having gone through

* Selenium tried in Cancer, see page 36.

two intermediate stages, *finally transformed into Radium*. In this complete change, with the continued “ emission ” of its rays, Uranium loses in atomic weight, and is found to have fallen to that of Radium (*i.e.* 226).

Uranium, as has just been stated, passes through two intermediate stages before being ultimately transformed into Radium. It has been suggested that it firstly becomes Thorium (which has atomic weight 232, and which has its own series of changes, see page 25). However, whether this is true or not, it is practically certain that *Uranium*, in slowly undergoing its changes, *becomes converted into Ionium*. (See pages 25, 29 to 32.)

Ionium, which is believed to be an element with an atomic weight of 230, and with an estimated life of 200,000 years, is said to be *the direct parent of Radium*, and to in time *produce Radium*. Ionium emits “ alpha ” rays, and thus loses “ 4 ” in atomic weight in dropping to that of *Radium*, which is 226.

Radium again, in its turn, is said to go through further intermediate stages, and *become* eventually in 2500 years *decomposed into Lead*.

In this process Radium (with its atomic weight 226), in throwing off the “ Radium emanation ” (or “ Niton,” with atomic weight 222), as well as its “ alpha,” “ beta,” and “ gamma ” rays, is found after one or two intermediate stages to consequently lose in atomic weight, and to at length become Polonium (with an atomic weight 210 ? also given 206 ; see Polonium and the theory of its transformation, pages 26, 27).

Now the radio-active body “ Actinium,” which emits “ β ” rays and emanations, and which on account of its rapid decay has a short life of approximately 30 years, and whose atomic weight has been suggested to be 220, on account of certain similarities between its emanation and the Thorium emanation, *may be* one of these intervening stages gone through by Radium before it reaches Polonium. (Ref.: see “ Actinium,” page 27.)

Returning again to Polonium, with an atomic weight of 210 (if this is correct?), this is said to last about 7 months, and to be emitting “ alpha ” rays, and thus dropping accordingly in atomic weight until it reaches

207, *which is the atomic weight of Lead*, and which Polonium is supposed to be transformed into (also see page 27).

Thus "Lead" is believed to be the final and ultimate product of the Radium Series.

• Whether these changes are actually taking place as stated, and the reasons to account for them, are as yet unknown to Science. •

The element "Helium" is mysteriously given off at various stages of the disintegration, brought about by radio-active changes. The causes also to explain this are not as yet understood.

However, it does seem to be undoubtedly true, that the element *Uranium* (whose origin we know nothing about) seems, in its long life and complete change, to be going through various intermediary stages, and to then *become transformed into Radium*; and Radium again, as outlined, seems to pass through additional transition stages, and then in the end *become "Lead,"* which is apparently a stable product.

As pointed out on page 11, these great transmutations are not taking place under millions of years, and all this time enormous amounts of "energy," in the form of rays and heat, are being cast aside apparently unused.

Here it is very interesting to note that these radio-active changes are governed by certain definite laws of growth, decay, and recovery; and it has been found that these radio-active changes cannot be accelerated or retarded by any known agencies, physical or otherwise, such as extremes of temperature, light, darkness, vacuum and high pressure, violent chemical reactions, or even electrical forces—all of which have been tried—but the rate of process has been found to *inevitably* and *irresistibly* go on. ("Beyond the Atom," J. Cox.)

NOTE BY AUTHOR.—The Transmutation of Hydrogen, etc., need not be dealt with here. But it is of scientific interest to remember that Norman Collie and Patterson found that Neon and Helium were produced from Hydrogen by bombarding it (the Hydrogen) with *Cathode rays*. (M. and W.)

• It is impossible to deal more fully here about so deep and so elusive a subject as the "Transmutation from Uranium into Lead." •

Nevertheless, this great point is most ably dealt with by Professor J. Cox in his work, “ Beyond the Atom.”

“ *Helium* ” has been previously mentioned as being produced at various stages of radio-active change. Before concluding, the following points about Helium may be of interest.

Helium. • He = Atomic Weight 3.99.—The name is derived from the Greek word $\text{H}\epsilon\lambda\iota\omicron\varsigma$, the Sun. Helium is occluded in various minerals, especially in Uranium and Thorium. (M. & W.)

Two milligrammes of Helium can be obtained from 1000 tons of Uranium per annum, while from the Thermal Springs in France one alone may yield 10,000 litres of Helium in a year. (“ The Extra Pharmacopœia.”)

Helium is an element, and is one of the family of Monatomic gases which are completely inert and form no compounds, nor can they be absorbed chemically by any substances whatsoever. (Soddy.)

It is an uncondensable and unabsorbable gas, and is extremely difficult to liquefy, though it does so at -270°C .

“ Terrestrial Helium ” was most unexpectedly disengaged by Ramsay from Clèveite, one of the heavy Norwegian minerals, otherwise Helium, as we know, was originally discovered in the Sun.*

Helium, as explained, is given off at various stages of the disintegration to Lead, and is itself a permanent element, and in that sense an ultimate product, and has often been termed “ Nature’s ultimate product from Radium.”

• Helium is *not* “ radio-active ” in itself.

Induced Radio-activity.—From the table on page 23 (or Plate 3) we saw that some of the radio-active elements possessed the faculty of imparting their activity to other substances.

As we know, in electricity by “ induction ” we are able, upon bringing a body electrically charged within the proximity of an uncharged body, to impart upon it (the uncharged) an “ induced ” electrical charge of an opposite sign, *i.e.* positive or negative.

* See page 38.

In a similar manner with the "Radium emanation" we are able to render substances, either brought close to, or better still, *immersed in the emanation* coming from Radium, to themselves become "radio-active" by this treatment of "induced activity" (or excited activity).

The "induced activity" consists of the "a," "b," and "g" rays, and is in the form of an "active deposit"; this "induced activity" can only be produced when "emanations" from Radium are present. (E. B.)

The substances which have been temporarily made "radio-active" by the "induced activity" behave as if "active matter" had been deposited upon them by the Radium emanations.

This "active deposit," however, can be partly removed by rubbing off and by dissolving in strong acids (E. B.); in fact it possesses definite chemical properties (as stated page 14).

Whether this "induced radio-activity" can be permanently retained it is difficult to say, the probability being doubtful, although experiments have shown that it lasts for hours and sometimes for days even after the Radium has been removed.

Willemite (ref.: pages 8, 13), for instance, can be made "radio-active" when it fluoresces with a beautiful green colour, and diamonds upon being rendered "radio-active" become phosphorescent; other precious stones also which have lost their colour by heat can be restored by the action of Radium.

Great attention must be paid to this fact of "*induced*"* or "*acquired*" activity, as the work later upon the "New Activity" will go to prove whether the "New Activity" is either:—

- (1) One of the known "radio-active" elements or compounds, or
- (2) Whether it is some substance synthetically treated

* Re "Induced" or "Acquired" Activity, Professor Curie observed that in addition to his instruments he himself became radio-active. Note also for examples of results arising from vitiated or "induced" radio-activity, see pages 89, 95, and 105 in the "New Activity."

by one of them, and thus rendered “ active ” by “ induced activity,” or

(3) Whether it is a “ *new form* ” of radio-activity in itself, also capable of rendering other bodies “ radio-active.”

Of course, even to have discovered the secret of successfully imparting from a given small quantity of Radium “ Radio-activity ” of a both powerful and permanent nature to ordinary every-day materials useful for commercial purposes is a triumph in itself.

Stress must be laid on this point, as will be observed later from the claims put forward in the “ New Activity.” (See pages 90, 95.)

RADIUM, RADIO-ACTIVE ELEMENTS, THEIR USES, ETC.

The discovery of Radium by Madame Curie may be said to have been a masterpiece of Science, worthy of the greatest praise and admiration. Great things were hoped would be the outcome of this event. Radium, on account of its being only a recent discovery, may be spoken of as being more or less in its infancy; and with regard to its capabilities and commercial uses probably its full possibilities have yet to be realised. The author regrets that he is unable to say much about the successful uses of Radium. Although he has made a very special effort by consulting experts and standard works upon the subject, he has been unable to arrive at a definite and conclusive opinion.

Radium and Therapeutics.—One of the first applications of Radium was its use in medicine. On account of the burning nature of its “ rays ” it had always been hoped that this could be made use of for destroying skin and other diseases, by applying the “ Radiant energy ” evolved by the disintegration of the Radium atom. And much experimental work has been carried out in this direction with a view to curing “ *Cancer*.”

The author must repeat again that he cannot claim to be well or perhaps fully informed on the matter. Although he has had the privilege of reviewing various reports from hospitals, doctors, and has read the report of the Radium Institute, and so forth, he has found so

many conflicting results, which have led him to *not* be in a position to say much about it.

Briefly, in therapeutics both the "a" and the "b" rays of Radium (or other radio-active elements) have chiefly been made use of for curative purposes; the "b" rays are mostly used and do for "Rodent Ulcers," for instance, but in some cases "a" rays are better; the "a" rays will not penetrate tissues, and therefore if the Radium used is contained in glass no "a" rays can get out. (Also see pages 8, 15.)

One of the reports which the author has read dealing with the "action of the Radium rays" says that: 25 milligrammes of Radium killed in a few days the organisms of cholera, anthrax, and typhoid fever, through their only being exposed to the "rays."

Such results as these are of course truly wonderful.

Radium is bactericidal and analgesic in its action. The exact action of Radium upon bacteria is two-fold; at first a stimulating one, but after a certain degree an inhibitory action sets in. These results have been found by German investigators.

It would appear that where Radium has been unable to cure a malady it has very often been able to arrest and check its further development, and it must be stated that by using the "Radium radiation" most extraordinary results have been attained. By juxtaposition, Lupus, Rodent ulcers, and Epithelioma have been cured.

One of the difficulties apparently in obtaining satisfactory results is in getting the right application, and to facilitate this many "applicators" have been made, and Radium carbonate, on account of its insolubility, ~~should~~ be most suitable for coating these. (M. & W.)

A report states that a case of Tuberculosis verrucosa cutis on the palm of the hand, which incidentally had been under treatment for three years, was completely cured by the application of two tubes on seven occasions for thirty minutes each. It also says that a case of "Rodent Cancer" of the nose was successfully treated by the application of two tubes on eight occasions; and further, it mentions that twenty-three different cases of "Rodent ulcers" were each independently effectually

cured, while cases of “ Rodent ulcers ” on the eyelids have been specially successful by treatment from Radium.

In the experiments upon “ Nasal Polypi ” the Radium treatment, however, proved unsuccessful.

It is hoped that Neuralgia and nerve diseases may yet be advantageously treated by “ radio-activity.”

Another report refers to sixteen cases of “ Trachoma ” treated by Radium. Out of these sixteen cases seven of them were successful, the result, therefore, though good, being less than fifty per cent.

In cases of “ facial paralysis,” Radium treatment has been good.

In addition to employing the “ Rays,” solutions of Radium have also been *hypodermically injected*, on the supposition that the Radium will continue to generate its “ emanations ” in the tissues, and the value of this may be proved by its arresting the advancement of malignant growths. In these experiments one-tenth of a milligramme of Radium in one cubic centimetre of water was the solution used.

All the past-mentioned work refers to that carried out before the commencement of the war.

Great attempts have, as we know, been made to cure Cancer with Radium; but as far as can be gathered up to the present Radium is certainly not a cure for the disease. All manner of different methods have been tried for curing it, but so far a practical and satisfactory cure for Cancer is not yet known.

In some cases where Cancer is claimed to have been cured, it has since been found that the disease was not originally Cancer at all; and in other cases, where patients have genuinely suffered with “ Cancer,” and have relied on Radium for a cure, it has been unsuccessful as well as tremendously expensive. The author is himself aware of two or three deaths which have been caused by the “ Radium treatment,” and, furthermore, there have been indications that if “ Radium ” had not been resorted to life would probably have been prolonged.

During recent years the metalloid “ Selenium,” *

* Also see page 29.

among so many other * things, has been tried with a view to curing Cancer. Whether the treatment has been successful or not the author has been unable to establish ; but malignant growths which have been treated by Selenium-oxide *seem to have improved*. Selenium-oxide has been used on the assumption that it conveys Oxygen to the Sulphur in the organism, and thereby increases the secretion of Sulphuric Acid (H_2SO_4) in the urine. This excretion, it has been observed, is *lessened in Cancer patients*. ("The Extra Pharmacopæia," 16th edition.)

And again, although so much has been said about the great value of the "Radium treatment" for "Rodent ulcers," etc., the writer hears from a friend of his (a medical practitioner with years of experience) that the treatment of "Zinc Ions" for this purpose is far more reliable and efficacious, to say nothing of the greater simplicity and more moderate expense.

This doctor referred to, from his own cases of "Cancer upon the breast," found that by making an incision and inserting the tubes (containing Radium) into the breast the cancer seemed to be temporarily stopped; but he also noticed that after this treatment the Cancer later on returned, and set in worse than before.

As well as "direct" treatment of Radium, indirect treatment is said to be efficacious. This we find at watering-places such as Bath, Llandrindod, Droitwich, etc., where the beneficial results obtained (when they are ?) are said to be due to the "natural" "radio-activity" inherent in those waters.

There are then two kinds of Radio-active waters, namely:—

(1) The "*Natural*," as mentioned, which contains usually both Radium and Emanation, while

(2) Those manufactured "*Artificially*" contain only the Emanation,† which does not last permanently.

One of the best British "radio-active" waters is the

* Potassium has also been greatly tried as a Cancer Cure by the late Dr. Ross. For work on Cancer Research, see reports of Dr. Bashford, the Cancer Institute.

† N.B. Note.—Water has been found when treated by the Radium Emanation to give Neon and Helium. (Sir William Ramsay.)

“ Roskrow ” water, which is said to maintain its purity and activity indefinitely. (See “ Water ” and the “ New Activity,” page 135.)

Radium and Astronomy.—Again, one must remember that the “ Spectrum ” of Radium, together with the knowledge of “ radio-activity,” would, it had been hoped, be of great use to Astronomers; unfortunately in this, however, we believe they were very disappointed.

From the Spectra of the stars (*i.e.* which all contain a bright ground intersected with *dark* lines, viz. like the Sun Spectrum) and in the atmosphere surrounding them many of the elements known to us on this earth have been observed, thus showing us of what they consist—Huggins and Miller being responsible for this both wonderful and important discovery. Now in the case of the Spectra of certain Nebulæ (which consist of solely *bright* lines, an important difference to the “ Stellar Spectra ”) *only* Hydrogen and “ *Helium* ” have been detected.

Therefore, considering the relativity between Radium and “ Helium,” as well as the fact that Helium is the ultimate production of Radium, it had naturally been thought that from what could be learnt of Radio-activity here it might in some way indicate better the early origin and later evolution of these elements in the Nebulæ, since the Nebulæ are supposed to be the origin of “ Solar Systems.” (Laplace.)

Sir Norman Lockyer first discovered the element “ Helium ” in the Sun in 1868, and we now know that many of our hottest stars are also practically composed of Helium. Consequently there is every reason to believe, since “ Helium ” is in the Sun, that Radium is probably present too. In which case it may be inferred that the *heat* of the Sun will continue to be radiated into space for a *longer period* than was originally thought. (W. W. B.)

Radio-Activity and Evolution.—One of the great tenets against the “ Theory of Evolution ” had been, that it did not permit sufficient time for the Geologists to account for the deposition of the observed strata, nor did it give the Biologists long enough to allow for the development of the known types of living beings to have evolved from primordial life, and reached their present state.

But the discoveries of Uranium and Radium tended to disagree with this argument, and more than ever supported the "evolution theory," since it allowed both the Biologists and the Geologists to *add on many million more years to the existence of this world.* (W. W. B.)

Geologists, as we know, have estimated the age of the earth since denudation began by certain measurements of the integral effects of denudation. (J. Joly.)

And it is now certain that the present state of affairs must have existed for far longer periods than 100,000,000 years, as was at one time imagined. ("Beyond the Atom.")

Although, from the examination of the "rocks" to-day, we have been able to deduce something about the past history of our globe; from the study of Uranium or Thorium (the parent radio-active bodies) we have been unable to learn anything about their origins, or subsequent progress.

Certain markings or "Pleochroic Haloes" * have been found in some of the "rocks" (as stated before, see page 17). These are said to be due to the *radiation from "alpha" rays*, on account of the extraordinary uniformity of the radial measurements of perfectly formed haloes. (Ref.: "Pleochroic Haloes," J. Joly.)

These haloes have *not* been found in any of the younger igneous rocks, and probably no halo less than one million years old has ever been seen, so this is clear evidence of how little we know about the early stages and properties of Uranium or "radio-activity" and of their various "transformations," etc., which have been slowly going on during the past ages. (Notes taken from Professors J. Cox, J. Joly.)

Radium, and the Obstacles to the Utility of It.

* These minute objects have long been known to Petrologists. Recent explanation shows that they are formed around particles containing radio-active matter, and are caused by an effect of the alpha radiations on certain minerals of the ferro-magnesium group. Radio-active haloes may, therefore, be derived from Uranium or Thorium, and the series of the alpha-ray changes (characteristic of the radio-active transformations originated by these parent substances) determine the dimension and structure of the halo. It is easy to refer a well-developed halo to one or other of these parent substances. (Ref.: Prof. J. Joly, F.R.S., lecture at the Royal Institution, London, May 11, 1917.)

Undoubtedly the small quantity of Radium existent, as well as its *great expense*, and the knowledge required to understand its complex nature, together with the rare apparatus it requires, etc., are among the reasons which have handicapped it from being used on a large scale.

The actual value of Radium has been very difficult to determine.*

However, one statement says that Radium Chloride (which is a white powder) is worth £15 a milligramme, or about £1000 a grain. (J. Cox.)

Another statement says that an ounce of Radium is worth more than £400,000 (H. P. S.), so in the present conditions Radium is naturally beyond the reach of most commercial propositions.

But like the “forces of Nature,” little has yet been done to successfully harness them for the use of man, and so, once the “activity” of Radium can be *easily* and *cheaply* utilised, there is no reason why this enormous energy should not make great progress in the advancement of the Universe.

Radium has been actually harnessed by the Hon. R. J. Strutt (Lord Rayleigh’s son) and made to drive a clock. In this case the “Radium energy” supplied by an active preparation of 30 milligrammes of Radium Bromide is displayed in the form of “motion.” The clock in this clever experiment has been going continuously for some years, and is said should possess the power of running 30,000 years before being exhausted.

The clock was made by the adaption of a gold-leaf electroscope; and if the parts used could only last, it would be the nearest man-made device to “Perpetual Motion.” (H. P. S. pages 518, 1271.)

Radium and Life (Plant and Animal).—Radium energy has been tried for other purposes besides those mentioned. Experiments were carried out with regard to its assistance in Agriculture, but, like the “forcing of crops by electricity,” little can be gathered of the methods adopted or

* NOTE.—£15,000 was paid for a gramme of Radium by Sir Ernest Cassel and presented to the Cancer Research Institute. Ref.: *The Daily Chronicle*, Saturday, February 15, 1919.

of the results obtained. Here, again, expense and elaborate mechanical apparatus would retard its successful use on a wide scale commercially.

. In this case no doubt the "Radium energy" would have to be of a weak strength and correctly applied, the plants being treated accordingly, since it has been found in the laboratory that "Radium" destroys the vitality of seeds,* and a tube of Radium placed on a leaf caused the irradiated area to lose its Chlorophyll and assume autumn tints. (*Proceedings of the Royal Institution.*)

While in the experiments carried out upon living matter, those results found with "bacteria organisms" have already been mentioned. (See pages 17, 35.)

Radium has also been tried upon animals, and where guinea-pigs were injected with Radium they succumbed, and caterpillars and other small creatures are found to be killed by being enclosed in a small box containing a little Radium. (Also note contrast to "New Activity," under "Stimulation of Life," page 130.)

Fraudulent Radium.—"Wherever there is Truth, there is always the counterfeit of Truth."

And so with the advent of Radium into the world many and various fraudulent articles were placed upon the market under the disguise of being either "Radium" or "radio-active." The author remembers being much amused at seeing at "Exhibitions" and so forth small samples of phosphorus, or the like, being sold to the ignorant public as Radium. And especially one may have seen, as he has, watches for sale in jewellers' windows marked at the low price of five shillings, etc., and being described as having "Genuine Radium Hands," whereas of course it was luminous paint of an inferior kind which the public purchased under the pretence of Radium.

Uses of other Radio-active Elements.—With regard to the *other* radio-active elements, Polonium, since we find in therapeutics that many valuable results can be derived from "alpha" rays, should be of considerable use to us.

Meso-thorium, incidentally, is claimed to be just as

* Note contrast under "Germination" and the "New Activity," page 115.

efficient for medical purposes as Radium itself, while Thorium is certainly used extensively in the manufacture of gas-mantles.

The “nitrate of Uranium” used internally has been successful in cures for diabetes, and it has also been largely used as a throat-spray. The author himself knows of a case where “Rodent Ulcers” were successfully cured by Uranium in five weeks, previous treatment having failed.

It has been difficult to gather further information on this subject (*i.e.* the uses of radio-activity).

In contrast great claims have been put forward as to the cheap, simple, and practical uses to which “The Dickinson New Activity” lends itself, as will be seen later. (See pages 99 to 141.)

And finally, during the last few years great strides have successfully been made in the utility of this for everyday commercial matters.

REFERENCES AND BIBLIOGRAPHY, ETC., TO PART I—CHAPTER I

The previous work on Radium, and that throughout the book, has been written by the author with the guidance and personal assistance of his colleague, Mr. W. Wortley Baggally. (W. W. B.)

The writer is also extremely indebted (for references on Radium, etc.) to Drs. Martindale and Westcott, for the continual and frequent use of their work, “The Extra Pharmacopœia,” various editions. Valuable help and information has also been rendered by :—

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SUPPLEMENT FOR ANY ADDITIONAL NOTES, ETC., ON PART I—CHAPTER I

Final Notes on Radium

Yield of Radium.—The latest estimation of the yield of Radium gives 0.25 gm. of pure Radium Bromide from the ton of Pitch-blende residues.

The following are also "radio-active," and for simplicity were not included in the correct places where they should have been dealt with :—

Air of caves and of cellars has often been found to be "radio-active."

Ordinary atmosphere is slightly "radio-active."

Glass has been found to possess "radio-active" properties.

Air bubbled through certain tap waters has been found to be "radio-active."

And *Rain*, a Cambridge scientist has recently found that freshly fallen rain is "radio-active."

(These notes are from C. R. Gibson.)

SPECIAL NOTE BY THE AUTHOR

In Chapter I. : While dealing with Radium and the other "radio-active bodies, the Author has endeavoured to the best of his ability to bring chiefly the generally known or "popular" side of "radio-activity" up to date. This chapter is not intended to be only for the Layman, but also for the Scientist; in fact, much technical detail has especially been included as a useful guide to those engaged upon individual research.

The majority of the work in Chapter I. has been written with particular attention drawn to those points which are later utilised as arguments in the bringing to light of Mrs. Dickinson's claims, to having discovered a New "Radio-Activity."

Chapters II. and III., Part II. : The Author has chronicled these two chapters entirely at the request of Mrs. Dickinson, and from the information, notes, and reports placed before him.

These chapters are in the form of "notes," like most of the work has necessarily had to be. All the work referring to Mrs. Dickinson's discovery represents in judicious scientific terms what might be called a "faithful record" of what the Author "has been told."

The Author's own impartial and unbiased investigation is not yet concluded, and therefore he has only been able to hold himself responsible for *some* of the facts mentioned, namely, those which he states as having witnessed, or having independently confirmed and proved for himself.

It should be possible to read any part of this book separately. For instance, those only interested in Mrs. Dickinson's work are not bound to read Chapter I. on Radium.

“ A NEW ACTIVITY ? ”

A Thesis describing

THE “ RADIO-ACTIVE ” SUBSTANCE

hitherto called “ Radioleum,” or “ The Dickinson Organic Radium,”
as discovered by

MRS. M. DICKINSON, M.R.I.

By

F. A. HOTBLACK

PART II

THE "NEW ACTIVITY"

(HITHERTO CALLED THE DICKINSON "ORGANIC" RADIUM)

CHAPTER I

The "New Activity"—Its History.—"Accidents" in past history have often resulted in great discoveries or inventions. We all know how the little kettle boiling on the fireside is said to be the original idea from which men ultimately derived steam engines. Steam, of course, was not invented then, as steam cannot be invented, having been in existence from all time. But what was discovered by James Watt from that little kettle was the "application" of steam, a then hitherto unrealised force, for the use of man.

All children, also, have heard about the discovery of "gravitation" through a story having been woven round the apple falling to the ground from the tree, which observation, outlined for the first time scientifically, finally materialised in the "laws of gravity," as found by Newton.

And so beyond number are the great discoveries and inventions which have been found "*accidentally*."

Sometimes the greatest of ideas have been found by amateurs, or in primitive ways. Again, sometimes knowledge has only been snatched by the philosophers and students after years of toil; and yet again the fruits of a lifetime have often not been realised till years after

"Light, more Light,"

as Goethe, perhaps the greatest of all German poets, tell

us, has undoubtedly been one of the causes of the desire for progress, and it is to those hardworking souls, always restless, ever enthusiastic, who, in their research are always seeking that they may learn something more of the truths of Nature, that enlightenment comes.

And let us now turn from the moral of the past few lines, written to show what we owe to the “accidental,” to how it concerns us in the scientific world with regard to the discovery of “radio-activity.” Becquerel, as stated before in the chapter on “Radium,” found during his experimental research quite “accidentally” that Uranium affected a photographic plate without there having been any previous “Lighting.”

This fact, though it would appear of small import in itself, drew aside the curtain, showing an “activity” and laying the stepping-stone which, as we know, finally led to the discovery of “inorganic radium” later on by Professor and Madame Curie. In this case then this discovery was the merit of years of hard work, and one which only fell to the hands of those already prominent and eminent as investigators in the scientific world.

Whereas in the case of the “New Activity” this again was the result of “accident,” but this time its birth is associated with more primitive methods.

To woman, again, fell this great opportunity, when several years ago Mrs. Dickinson, an English lady scientifically interested, was experimenting.

The origin from which Radium was derived was Pitch-blende, this time the source (of Mrs. Dickinson’s Radio-Activity) was found in a mixture of oils and gums.

The history of Mrs. Dickinson’s discovery is of too complex a nature to here relate fully, but let it suffice to give only a “general summary” on the matter, as far as the writer is able from his notes.

History.—Early in 1911 Mrs. Dickinson (whose attention was by then no longer required at the bedside of the sick, as it had necessarily been for so many years in the past, during the late Mr. T. G. Dickinson’s lifetime) began her experimenting, firstly as a hobby, *with a view to finding a “perfect antiseptic” for medical use*, which in quality should supersede all others, and which should,

as she felt was so badly needed, be of a pleasant and refreshing nature at the same time.

For this purpose Mrs. Dickinson commenced and conducted for the next two years an active research into all the known substances of an antiseptic nature. While at this work she spent much of her time in studying the Oriental "essential oils," as Mrs. Dickinson, when previously travelling in the East, had always been impressed by the healing, health-giving and preserving qualities of these vegetable oils; and so with the evidence and assistance of modern science, Mrs. Dickinson patiently devoted her energies in endeavouring to rediscover the therapeutic properties of these oils, which, as we know, had once been so greatly valued in the past.

And it was in the following Autumn, while on the research of these rare Oriental Organic oils (such as those from the cinnamon groves, the lemon bushes, the orange trees, and the pine forests, etc., together with many of the rare Eastern gums, and also using Silvester, pitch-pine, spirit, and many of the Western essential oils like lavender, laurel, rosemary, violet, etc.) that Mrs. Dickinson found that by a certain blending of these, according to ancient and traditional rights, already known to her from both the inspired* and the ancient Egyptian writings, that she could produce an "*Antiseptic Perfume*" of exceptionally high therapeutic and germicidal value, and one whose aroma at the same time was sweet in the sick room.

And so it was to this "*Antiseptic Perfume*" and to a great many other hygienic preparations that Mrs. Dickinson gave her attention for the next year or two in developing commercially. One point is worthy of great interest to note here, and that is, that these preparations (the results of her labours referred to) were highly successful; in fact, the "*Antiseptic Perfume*" † was awarded,

* *Inspired* refers to a particular illustrated "Pictorial Bible," all vols., with special original notes and pictorial illustrations, published by Charles Knight & Co., 22, Ludgate Street, London, 1836. Printers: W. Clowes & Son, Stamford Street, London (MDCCCXXXVI.).

† Called, "DONGOR," after the name of Mrs. Dickinson's private firm, who control her productions, etc. "Dongor," dev.: an inversion of the name Gordon; in memory of Mr. T. G. Dickinson.

entirely on its merits, the Silver Medal and Diploma at the 17th International Congress of Medicine, on August 13, 1913, as well as other less important awards later, such as the Certificate of the Institute of Hygiene, September 13, 1913, etc. (See reports, pages 164, 165.)

And now having dealt with these seemingly rather obtruse details, the reader should be better able to grasp and understand the causes which led to Mrs. Dickinson being in the scientific position which she was at the moment of her greater discovery of a “new radio-activity.”

The Discovery of the Radio-Activity.—At the close of 1913 Mrs. Dickinson, while engaged in the pursuits of her hygienic preparations, was preparing an “Antiseptic Medical Cream-Soap,” intended for the use of surgeons (in which was employed, together with certain saponic fatty compounds, a mixture of these oils, resins, etc., already referred to), when it was constantly noticed that certain minute crystalline particles were found to have become precipitated upon the paper at the top of the jar covering this antiseptic cream-soap. (See Plate 6.)

For some time no attention was paid to these, it being thought that they were probably due to some impurities accidentally present.

However, upon the appearance of these continuing, Mrs. Dickinson herself, on December 24, 1913, determined to examine these “crystalline particles” formed in this way, and to, if possible, determine the cause of their presence. She first looked at them under a magnifying-glass, and later under a microscope, and on account of their unusual character and reddish-brown nature, together with the fact that they glittered and scintillated in the sunshine, and appeared to her to be in some “active” state, Mrs. Dickinson, by a lucky inspiration, exclaimed “Radium!” since she imagined from what she had heard that Radium so appeared.

She thereupon took up the study of examining them carefully, and as she could not account for their presence, she naturally next examined the oils and gums, etc., which she had been employing; but it was found that they were pure, clean, and clear individually, and

PLATE No. 6.

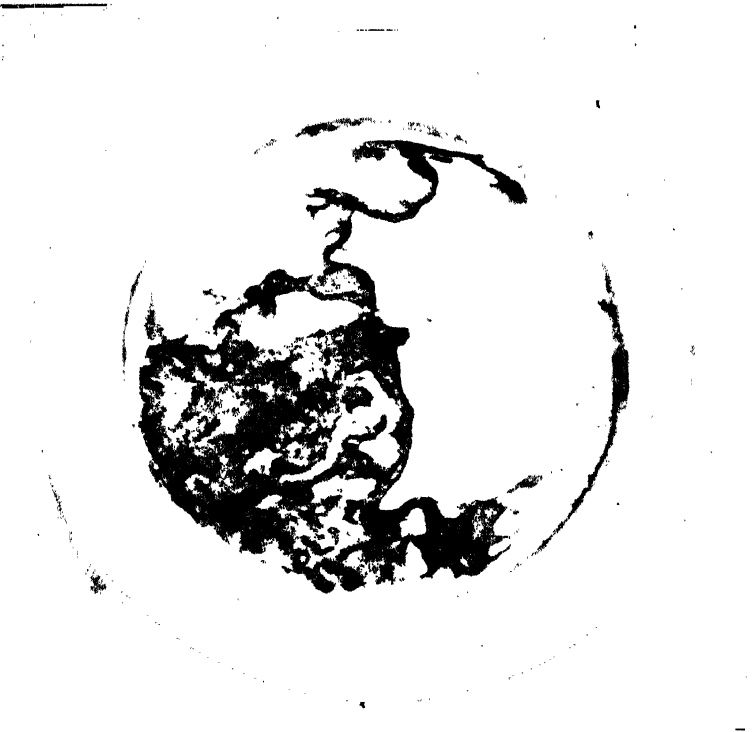


Photo by Tanner, Brighton.

Reproduced from Brighton and Hove Society, April 23rd, 1914.

WHERE MRS. DICKINSON'S RADIO-ACTIVITY WAS DISCOVERED.

The above illustration shows how Mrs. Dickinson made her discovery. It is a reproduction of the photograph of the actual piece of white tissue paper which underlaid the lid of the "Oil and Antiseptic Cream Soap Preparation," which became stained and upon which the minute crystals were ultimately discovered. (See page 51.) The photograph shows the stain.

(Ref. page 50, line 21.

contained no *solid matter*, having previously been filtered several times; these facts then suggested that these "extraordinary minute crystalline particles" must have been formed by some chemical combination having taken place among the constituents used.

Whereupon Mrs. Dickinson's interest became solely and entirely centred upon these very tiny crystals, and she then decided to find out whether they possessed any "active" properties like Radium, or not. Since, if they did, she felt that it would account for many of the exceptional qualities which she had observed that her "hygienic" preparations had possessed in the past, but of which she had not, at the time, understood the origin and cause.

She, therefore, soon settled to take the matter up, and to seriously inquire into the properties of "Radio-Activity," and firstly showed these crystals (as well as to her intimate personal friends) to a journalist (*i.e.* Mr. Cayley Calvert), who had a wide knowledge of most things. He was interested in their origin, and much impressed by their earthy and rather beautiful mineral-like appearance, and said they looked more or less like Pitch-blende. Following this, Mrs. Dickinson then showed some of these minute crystalline specimens to a doctor, a London Specialist, and asked him about Radium. He examined the crystals under his microscope, and was more than interested in their brilliancy and nature; but, of course, he could not believe that "Radio-Active" particles could be obtained otherwise than from Pitch-blende, the known source, and remarked, "A chemist ought to analyse them."

Mrs. Dickinson then, naturally enough, at once went to the head chemist of a well-known London chemical firm (*i.e.* Messrs. Savory and Moore), who had originally specially obtained these oils, etc., for her from the East, and told him everything, and asked him what the crystals were? or, if he could account for their appearance? He replied that he could not, but said, after examination, "*That they reminded him of a kind of refined Pitch-blende.*"

Much surprised, though unsatisfied by this verdict, Mrs. Dickinson then went and purchased a new microscope, also from a London firm (*i.e.* Messrs. Dixeys), who,

when they were shown the crystals, were so impressed by their originality and apparently "active" state, that a member of the firm remarked that they reminded him of Mount Vesuvius in eruption.

Then, with the aid of her microscope and other apparatus, Mrs. Dickinson began her research and commenced exhaustive experiments, and found, among other things, that further of these little very minute shining crystals could be collected from blotting or filter paper saturated with the mixture of the oils, gums, and spirit, etc., already referred to.

And so the investigation of this work continued rapidly during January and February, when in March, 1914 (the 26th), Mrs. Dickinson, as well as exhibiting her "original" productions, also demonstrated some effects which could be produced upon crude oils by her discovery at the World's Oil Industries Exhibition at Earl's Court. (Ref. : B. & H. S., March 26, 1914; April 9, 1914.)

These results aroused such great interest and enthusiasm among the oil experts there, that Mrs. Dickinson was requested to go further into the research of oils, and it was a little later, while trying some "fusing" experiments (as she had been asked to do) with some of her oils and crystals, which happened to be in a closed retort boiling over a Bunsen Burner, that an explosion took place, which resulted, so Mrs. Dickinson asserts, in forming a new, hard, transparent crystal like a diamond (*i.e.* not reddish-brown as the original).

Incidentally, Mrs. Dickinson now possesses a number of these, but she states she has been able to obtain them by other and different methods. (Referred to elsewhere, page 64.)

One of the first indications that these crystals produced some form of "rays," similar to those of Radium, was soon discovered, when in the following April Mrs. Dickinson found that these crystals, upon coming in contact with the skin, burnt it, by firstly causing a spot, followed by a surrounding ring; although in time the spot and the ring disappeared, and the skin was found to show no signs of a burn. (Ref. : B. & H. S., April 2, 1914.)

Mrs. Dickinson then began trying what effect her

PLATE No. 7.



Photo by Norton & Co., King Street, Covent Garden.

A RADIO-ACTIVE CRYSTAL.

The above illustration is a microphotograph, considerably enlarged, showing a Specimen of the " Dickinson " crystalline substance, which produces " Radio-Active " effects.

crystals had upon *practically everything imaginable*, and soon observed that ordinary dirty wool, straight from the sheep's back, could be exceptionally well cleansed by soap made "Radio-Active"; the success of the process being claimed to be due to the "Radio-Activity" treated substances in the soap, which, it was found, in no way impaired the virtue of the wool, as the usual acid preparations would have done (see "Wool," later, page 138). (Ref. : B. & H. S., April 16, 1914.)

As her various experiments continued, Mrs. Dickinson found that ordinary Water when treated by her crystals (*i.e.* which was really rendering it "Radio-Active") had a marked "stimulating effect upon the growth of plants," from some wallflower and fern experiments which she had carried out. These experiments, which were witnessed, naturally caused great interest at the time. (Ref. : B. & H. S., April 30, 1914.)

Among other things, Mrs. Dickinson then improved upon the "charging of the water" by her crystals, and found that she could produce a successful "Radio-Active" drinking water for the Table (which, incidentally, is still on the market to-day). (Ref. : B. & H. S., April 30, 1914.)

On account of these many properties to be derived from her crystals slowly coming to light, Mrs. Dickinson was more than ever convinced that there was something extraordinary and unusual in the crystals, and began definitely experimenting on a still more "scientific" basis, to determine further the actual "reality" of their "radio-activity," and consequently turned her attention to seeing whether they would give any "photographic" results, similar to those produced by "Radium" or "radio-active" bodies.

And in June it was proved by photographers that they possessed "radio-active" properties, as a tube containing the crystals from Mrs. Dickinson's oils produced a photograph (*i.e.* a shadowgraph) on a sensitive photographic plate *through* paper, by being placed upon it in the dark; and wool also, by being saturated with Mrs. Dickinson's "radio-active" oils, was found to affect a photographic plate, by being placed upright in front of it some 8 inches

away in the dark, and by being left for a few hours. (Ref. : B. & H. S., June 4, 1914.)

Closely following these results Mrs. Dickinson next suspected that her crystals might possibly produce electrical effects, since it was found that an “electrolytic action” could be set up by the oils (Ref. : B. & H. S., July 16 and 23, 1914); and later, it was also found that *some* of the crystals could discharge a charged gold-leaf Electroscope; and so during the remainder of the year many and various were the experiments carried out upon both the crystals and their application to other matter.

The most notable of the latter being that by utilising the “Radio-active” oils, water, and the “Radio-active” crystals, Mrs. Dickinson found that Gold could be successfully separated from the Arsenic in certain Welsh Ore. The process, which was otherwise one of great difficulty, was accomplished in a few hours by the application of Mrs. Dickinson’s “Radio-Activity.” (Ref. : B. & H. S., July 30, 1914.)

Another point upon which a great deal of time and energy was spent was in the making of Bread by flour and water only, the point of importance being that no yeast was used, since the “radio-active” water was found to set up a natural “active” fermentation with the flour; and from this the bread was made (also referred to fully later, page 103). (Ref. : B. & H. S., December 24, 1914.)

After this Mrs. Dickinson continued to patiently persevere in her work, still experimenting in all directions, and in the following year she exhibited at a Scientific Exhibition at Brighton (*i.e.* the Congress of the South Eastern Union of Scientific Societies, June 2-5, 1915) numerous specimens, illustrating her new “discovery” and its application to Bread making without yeast, and to wool cleaning, and she also showed her “radio-active” oils, and many other things.

The judges (namely, Professor W. F. Gwinnell and Mr. F. W. Keeble) were interested and examined the many things, as well as Mrs. Dickinson’s crystals, and one of them, the Professor, pronounced the crystals to be “radio-active,” and when requested to do so, wrote out a statement to that effect.

Following this, Mrs. Dickinson continued her investigations, and was fortunately for some time very kindly assisted "scientifically" in her research by the two scientific men who had been the judges at the recent exhibition.

As time elapsed Mrs. Dickinson returned again to her "Wool cleaning" process, which she next showed to a well-known firm of wool merchants. There she met their chemist, who happily knew about "radio-activity," and who was much interested in the story of Mrs. Dickinson's "discovery," and at once told her to test her crystals in a Spinthariscopescope.

Accordingly she immediately went to the opticians, Messrs. Beck & Co., and purchased a Spinthariscopescope, which was *new*, and *which had never been previously used*, and had one of her crystals, which they selected and picked out from a number, mounted there and then in the instrument. Upon the crystal being inspected in the dark-room *scintillations were observed immediately*. [Scintillations, as dealt with in Chapter I., page 6, are produced in the Spinthariscopescope upon a zinc-sulphide screen by the action of the "alpha" rays, emitted by a particle of Radium.]

Mr. Beck himself, who saw the scintillations produced by the crystal in the Spinthariscopescope upon a subsequent visit, was naturally greatly impressed, and said, "Where did you get this? . . . This is the first time I have seen Radium since its original discovery. . . ."

In the meantime, Mrs. Dickinson had returned to the chemist at the wool merchants, and had told him of the scintillations observed in the Spinthariscopescope, which, as will be remembered, had been tried at his request; he also saw the scintillations and was much impressed, as, by the way, have many eminent scientific men since, including Sir James Mackenzie Davidson.

He advised further *confirmatory experiments to scientifically prove* the "reality" of this suspected "radio-activity," and asked Mrs. Dickinson to see if her crystals could produce photographs (*i.e.* shadowgraphs) *through sheets of lead or aluminium*—which was thereupon properly carried out by photographers—and the results *indicated*

the presence of "radio-active" rays (see page 65). (Ref. : B. & H. S., November 11, 1915.)

Pleased with this great success, Mrs. Dickinson continued her work, still being assisted by the two scientists who had begun an investigation into her claims of a "*New Discovery*" in "Radio-Activity."

And a month or two later, on January 22, 1916, Mrs. Dickinson's first paper in connection with her work, entitled, "A New Discovery of 'Radio-Activity,' throwing off Radiant Rays," was read before the Brighton and Hove Natural History and Philosophical Society, at Brighton.

At this juncture Mrs. Dickinson, who was experimenting for a "coal substitute," found that soil and her "radio-active" water, when mixed together with a certain proportion of coal dust and baked into a "briquette," made a good "coal substitute."

Among her other experiments Mrs. Dickinson made a "radio-active" fertiliser, which she says was successful—while she also found that her crystals made diamonds more luminous. All precious stones, by the way, are, according to Mrs. Dickinson, the result of "radio-activity" in the earth.

One other interesting fact, which Mrs. Dickinson at about this time found, was that the scintillations from a crystal were brighter after being subjected to furnace heat, than they were before. (Ref. : B. & H. S., January 24, 1916.)

In the following May, this time under the name of "Radioleum,"* Mrs. Dickinson exhibited at a Scientific exhibition (*i.e.* the Congress of the South Eastern Union of Scientific Societies, held at Tunbridge Wells, May 24-27, 1916) the "Crystals," and also demonstrated many of the "applications" resulting from her "radio-active" discovery, such as : The yeast substitute, the wool cleaning process, the coal substitute, the fertiliser, the action on ore, the "radio-active" water, photos and photographic

* *Radioleum*, suggested by Professor W. F. Gwinnell, April 4, 1916, as a suitable name which expressed the source—*i.e.* the "Dongor" Oil (Der. : Latin Oleum) with the apparent Radio-Active property ; thus "Radio"—"Oleum" or "Radioleum"—giving the convenient adjectival term "Radiole" : thus "Radiole" Crystals, etc.

results, the paper cleaning, and certain microscopic effects on glass, and other things, upon which Mrs. Dickinson had from time to time in the past been engaged.

Among the many interested spectators, two prominent men took a great interest in Mrs. Dickinson's work, and one of them begged her to continue it, and urged her to consult a scientist of eminence regarding the validity of her claims as to having discovered a *new* "Radio-Activity."

When a little later a friend of Mrs. Dickinson's (*i.e.* Mr. A. W. Oke), and a member of the Royal Institution, who was interested in her work, took her before one of our greatest chemists in London, who, upon being shown the crystals and the photographs of them, etc., said immediately, "What have we here, Radium? . . . Well, only Radium could produce these effects. . . ."

He looked at the crystals, which he thought at first were glass or mica, but after examination pronounced them not to be either of these. Upon Mrs. Dickinson claiming it (one of her crystals) to be "organic," he at once said, "You can easily test whether it is "organic" by seeing if it carbonises; but you will have to sacrifice one of your crystals. . . ."

He strongly encouraged Mrs. Dickinson to continue her investigations, and gave her the names of some eminent men of science (*i.e.* Sir Oliver Lodge, Professor Rutherford, Professor Soddy), whom he advised her to consult on all matters respecting the subject of "Radio-Activity."

Buoyed up by this encouragement, Mrs. Dickinson then continued her investigations, working quietly at home, and while engaged upon the same she asked a scientific friend (*i.e.* Mr. F. W. Keeble) to independently test if her crystals were "organic" or not, by seeing if they carbonised. This he apparently must have done either now or later, as will be seen from his letter, of which an extract is given on the next page.

And it was not till later, in the autumn, that quite by an accident Mrs. Dickinson discovered, when on a journey to London (on September 16, 1916), that one of her crystals in a closed glass tube, which had been momentarily placed on the glass surface of one of the tables in the railway

carriage, had caused a very curious marking in the glass. (The glass of this table has been removed and kept for demonstration purposes.)

Mrs. Dickinson, like others, was so impressed by the curious marking in the glass that, on September 26, she took this table, together with her crystals, their photographs, and the photographs of them produced *through* metal, and other specimens of her work, and for a second time saw the eminent scientist whom she had some time ago consulted. He again saw some of the crystals, the photographs, and other things, and was much interested, and upon seeing the photographs, said : “ *Only Radium could do this . . . ;* ” but here it is, she says she can produce “ Radio-Activity ” from Organic matter ; well, if she can, and it can be found to contain Carbon, Hydrogen, Oxygen, and Nitrogen, etc. . . . why then, “ if this can be proved to be organic, it is the discovery of a new world . . . of which we know nothing . . . and will do naturally what we now do artificially, *but* it is too gigantic even to dream of. . . .

“ If you can come and tell me this is so after chemical analysis, why then I must congratulate you, as you will so richly deserve. . . . ” And he gave Mrs. Dickinson the name of a chemist to consult (*i.e.* Messrs. Savory & Moore), and he also recommended her to place her work before the Royal Society.

However, upon Mrs. Dickinson interviewing the chemists (*i.e.* Messrs. Savory & Moore) she had been sent to, and asking them whether they could tell her if her crystals were organic or not, they replied that they had already helped her as far as they could in the matter. . . .

In consequence of this, Mrs. Dickinson next sought the opinion of the scientific friend (*i.e.* Mr. F. W. Keeble), who had, as already stated, previously carried out experiments with her “ Radio-Activity,” who, upon being questioned, said (presumably referring to the crystals), in a letter written to Mrs. Dickinson on October 4, 1916 : “ The bodies you use are *organic*. . . . ”

[The writer, of course, feels that this will want further confirmation.]

Just before this latter date Mrs. Dickinson had been

put up for membership of the Royal Institution, where she next became subsequently elected a member on Monday, December 4, 1916.

Upon becoming a member of the Royal Institution Mrs. Dickinson was very kindly allowed by the authorities there to exhibit the "photographs" of her work, which she did, with the result that many people were interested in them, and Mrs. Dickinson was ultimately advised by a friend to consult Sir William Crookes of the Royal Society; but owing to his illness at that time she was unable to do this, and was then recommended* to see Sir William Barrett, who, when he became acquainted with the scintillations produced by the crystal in the Spinharscope, and with the crystals and their photographs, together with many other of the things, was naturally very interested, but very sceptical as to the source of the radio-activity.

Among Mrs. Dickinson's experiments being carried out at about this time, she had found that her "radio-active" water had a marked effect upon the "softening and removing of corrosion or scale" set up in boilers, and a scientific paper, called "Corrosion and its Prevention," was next read before the Brighton and Hove Natural History and Philosophical Society at Brighton, on January 20, 1917. (See page 175.)

And so, as just mentioned above, having at last placed her work in the hands of a scientific "authority" for investigation, the year 1917 to 1918 may be regarded as the close of Mrs. Dickinson's *own* work—or that work which she had carried out for four years practically unaided to establish a "New Radio-Activity," which, as has been shown, was originally accidentally discovered in 1913 in certain oil, fat, and saponaceous compounds, forming a "Medical Antiseptic Cream Soap."

Sir William Barrett, the scientific authority, shortly after his becoming acquainted with this work, asked his friend Mr. W. W. Baggally, who lived in the same town as Mrs. Dickinson, to look into Mrs. Dickinson's claims as to having discovered a "New" Radio-Activity. Mr. W.

* By Mr. A. Hastings White of the Royal Society.

Baggally thereupon commenced repeating many of the experiments referred to, with a view to confirming them; and he has been working independently and impartially on the subject ever since. A little later Mr. W. W. Baggally obtained the assistance of a friend, Mr. F. A. Hotblack, the writer, who has also, from a chemical and a scientific point of view, been independently investigating Mrs. Dickinson's alleged discovery. He has too been engaged ever since on a series of *test* experiments, which he has carried out to verify those of Mrs. Dickinson.

And now, having dealt with the “History-of-the-Origin” of Mrs. Dickinson's discovery, the writer will very shortly deal with the Scientific points of Mrs. Dickinson's work, after which its commercial properties are dealt with fully in the last chapter.

However, one cannot but help seeing how all these past-mentioned facts have been the links suggesting a “New” Radio-Activity; and on account of this, work has from time to time been carried out to definitely establish this as a fact.

As we once remarked before, not only does success lie in discovering and unearthing “natural forces,” but perhaps a greater success still is achieved by being able to “apply” them successfully for the use of mankind. And it has been with this particular point in view that Mrs. Dickinson has devoted her time, hoping not only to make her discovery a success “*scientifically*,” as Radium was, but to also be able to “apply” it for a world-wide, cheap, and commercial use.

Up to the present great attainments have been made in the last few years in this direction, so great, indeed, that the commercial assets deriving from Mrs. Dickinson's discovery are given a lengthy chapter quite to themselves in this little work; and before concluding and passing on to the next part, the “scientific and chemical properties,” the writer feels he can find no better place than to here say a few words about the discoverer herself, Mrs. Maud Dickinson, although to do this adequately a separate biography of her life would need to be written.

Mrs. Dickinson, though English by birth (born in Somerset), was educated and spent most of her youth in

Burlington, Iowa, America. Mrs. Dickinson was *always* a natural lover of the beautiful and scientific secrets of Nature. In Mrs. Dickinson is found a person of exceptional ability and talent, and one who has gained much knowledge from her wide travels throughout many parts of the world.

Mrs. Dickinson is undoubtedly a genius, since she has "*observed some new fact*," which is always said to be only the work of a genius. While beyond the actual "discovery of a new fact," Mrs. Dickinson has since conducted many clever and original experiments, with regard to its "application" to other things; and she has latterly begun to study deeply and more scientifically the work, though, of course, this remains for others to take up and carry on.

Mrs. Dickinson, previous to her exceptionally original discovery of a "Radio-Activity," was already an expert in Hygiene; in fact, she had once been humorously nicknamed the "High Priestess of Hygiene," and it was undoubtedly her analytical and inventive genius which led to her being the originator of over fifty different inventions and mechanical appliances, many of which are now well known.

This is surely a record for a woman, and one worthy of high veneration and honour.

One of the first and foremost features required in the individual conducting new experimental research is "Originality." In this respect Mrs. Dickinson probably stands alone and unsurpassed. This discoverer, unlike all other scientists, has not followed the usual beaten track of orthodoxy or convention. Her work, from its early experimental stage right up to its more advanced position of to-day, has been carried out in the face of great difficulties by her alone, and under most "original" and unique methods.

Secondly, it may be said that to be a successful experimentalist it requires unfailing "Enthusiasm"; for, being given the creative powers of "Originality" to be an investigator and a discoverer in the first place, it necessitates everlasting "Enthusiasm" to carry out one's work during the years which this study will demand.

"Faith" and "Confidence in Oneself" are also elements

which must be combined throughout everything, and to continue individual research means also a high previous general knowledge, as well as the continually keeping-in-touch with the topics of the day ; and one must have the imagination and perception to recognise and grasp as significant that which the ordinary untrained or less alert eyes have missed.

“ Time ” is of no avail where Science is concerned, and one must realise what this means when one has to set aside a period of perhaps several years of a lifetime to the faithful devotion to one’s work.

“ Expense,” again, is a matter which has not to be considered, and in this Mrs. Dickinson has devoted her entire means in the supplying of the necessary equipment, apparatus, books, travelling, assistants, etc., which from time to time her work has demanded.

Unfortunately up to the present little encouragement or help has been given from the outside world for the “ Prosecution of Science.” Those studying on the Continent and in America have, we believe, been more fortunate.

Yet, again, “ Fortitude ” and “ Courage ” must be possessed by discoverers, to enable them to perpetually fight the battles of disbelief, to break down the barriers of persecution, and to render them able to hold their own against those who are blind, jealous, or those whose pecuniary interests cause them to rank themselves as antagonists.

Great “ Patience ” also is required in the hour of failure.

And lastly, in harmony with all these, continual “ Self-sacrifice ” perhaps dominates in bearing its part.

So, when one thinks this carefully over, one begins to realise that the discoverer’s struggle has by no means been an easy one. All those who have had the pleasure of the acquaintance of Mrs. Dickinson will know of her undying “ Faith,” and they will also agree that she possesses in a great measure many of these other attributes.

Mrs. Dickinson has always considered before any ideas of fame or wealth the sacred cause of benefiting “ Humanity.” It was years ago that this discoverer

commenced her work, always hoping to possibly be the means of showing the world the way to cure Cancer ; and all through her life she has had this end in view.

The interests of the sick and suffering have always found a place in her heart, and much has already been done by her for their cause.

Mrs. Dickinson's main hope to-day is to be able with her " New Activity " to find a way to cure, or to at least mitigate, the sufferings of Cancer ; and, indeed, great hopes have been built up upon the possibilities which this " New Activity " may possess in the curing of illness and disease.

And it is of such few people as these in the world that we cannot say enough ; for we all undoubtedly owe to Mrs. Dickinson gratitude for her years of attempts, and we all hope also that the results of her work will not pass unmerited, but that they will bring with them the " crown of success."

For the benefits of her already successful productions there are many persons, especially at the present time, who have to be grateful for the clever inventive powers of this discoverer.

To a woman alone has this hard task befallen, and to her alone will be due the success which we feel sure will follow one day ; and now we will turn our attention to the results of her labours, in describing in the next part the actual " Scientific properties and characters " of her work.

ITS SCIENTIFIC PROPERTIES AND CHARACTERS

The words, Organic-Radium, have naturally led to much comment. Firstly and lastly it must be *clearly understood* that this is only the name given " in words " in contradistinction to that inorganic Radium discovered by the scientists Curie. The original idea of this substance being organic was derived from the fact that its source hailed from vegetable or organic oils. The exact position in chemistry of this substance (claimed to be a *new form* of Radio-Activity) is not yet fully understood.

Analysts have worked much upon it, but up to the present have formed no definite conclusions. That the substance is a New Element it is naturally difficult to

believe on account of its origin, but it is more likely to be some by-product hitherto unrecognised, which—

- (1) Either possesses a strong form of “activity,” as up to the present unknown; or
- (2) A product which is highly capable of having *induced* radio-activity imparted to it, and of retaining it.

A certain Professor of Science (*i.e.* W. F. Gwinnell), when investigating the matter, suggested it to be a natural vegetable product resident in the oils, but which possessed its “activity” on account of the trees from which these oils came, having been grown in radio-active soils. Clever though this suggestion may be, probability does not lend itself to this being the fact. The discoverer fully assures us that this substance is something *new*, possibly an element, possibly an unknown compound, and possibly organic, but, above all, possessing an “activity” in many ways similar to that which accompanies “radio-active” elements.

As the exact process of its isolation remains only understood by the discoverer, it is difficult for analysts to determine the exact nature of this somewhat complex substance. Upon seeing these “crystals,” if we may call them such, certain known materials at once suggest themselves. However, upon analysis it is found to be none of those suggested; and even if it were, they possess no form of “activity.” Up to the present only a certain amount of ordinary everyday analysis has been conducted upon them, without, as stated before, conclusive result.

So we must leave ourselves in the discoverer’s hands, until from experimental work, which is still in progress at the present time, this matter has been finally settled.

The original crystalline particles were of a reddish-brown nature, and fairly hard. The discoverer later on (as already referred to) found a process by which, upon submitting the oils, etc., under pressure, and igniting them at a certain temperature, she was able to eliminate crystals of a different nature to the former ones, but which also possessed the “active qualities.”

Mrs. Dickinson also states that she has been able to obtain them by other methods than those up to the present mentioned. One of her original theories being:

that from one of her radio-active crystals in a sealed glass tube she can collect others within the vicinity. Her explanation to account for this being, "that the rays (which are possibly of an ethereal nature,*) 'emitted' by the crystals pass through the glass tube as 'rays,' and upon coming in contact and mixing with the external atmosphere, condense down or oxidise, forming a nucleus and absorbing matter, thus becoming a tangible quantity from a ray having solidified, and taken on the corporeal form of a crystal from the moisture and matter in the air."

Should this astounding belief be true, it may in a measure be what an eminent scientist (*i.e.* Sir Oliver Lodge) once referred to, when he said, "that the day would come when we should be able to harness the Electricity of the Air."

However, it has been stated that Mrs. Dickinson now possesses, besides the reddish-brown crystals originally discovered, others of a different nature; and as it is with these later crystals that the majority of the work has been accomplished, and is being performed to-day, so it is to these in particular to which we will confine ourselves, and give our attention in describing. These crystals are hard, either opaque or transparent, and some look very similar to small diamonds or brilliants, and from their glittering nature, etc., observed in the early days, "radio-activity" was suspected. Among the first experiments to prove this were those tests tried upon photographic plates already referred to; but we will describe them more fully here.

The "New Activity" Affecting a Photographic Plate.

—The photographic experiments, which we have mentioned in the early part of this book as carried out by Becquerel and later again by others, have come to be considered very important among the scientific tests for "radio-activity." It has been stated how "radio-active" substances are able to produce "photographs" (*i.e.* shadowgraphs)

* It is interesting to note, Ether consists of Lines of Force (high tension electric currents) at right angles with one another. Their action upon one another *forms matter*; Sir Oliver Lodge suggests it may be fibrous in structure.

without any "lighting" upon screened photographic plates.

Mrs. Dickinson tells us that her first experiment to prove whether her newly-discovered activity could produce any effects upon a photographic plate was carried out in the following manner:—

A glass tube containing her crystals (extracted from the radio-active oils) was placed on the packet containing a sensitive photographic plate, which was wrapped up in black paper. This packet, with the tube on top, was placed in a drawer in a darkened room and left for apparently about 68 hours. The plate was then duly developed by photographers, when a clear "shadowgraph" of the outline of the glass tube was found photographed upon the plate. The photograph from this experiment has been published, and the photographers state that there was no error in the experiment. (See Fig. 1 of Photos.)

At the same time a further photographic experiment was made, and in this case some pieces of wool were soaked in the "radio-active" oils and placed some 8 inches away and in front of the sensitive plate in a darkened room. Again no ray of light was admitted. When the plate was developed curious impressions were found upon it, showing that a photographic action had been caused.

So both these experiments, as others, gave every indication that the crystals from Mrs. Dickinson's "new activity" possessed "penetrating rays," capable of giving photographic results, which were characteristic and more or less similar to those produced by Radium. (Ref.: for these two results, see Brighton and Hove Society, June 4, 1914.)

Over a year later a still further series of photographic experiments were made. In this case the discoverer had been asked to see whether the crystals from the "new activity" could produce photographs through the *metals aluminium and lead*. The following experiment was carried out:—

One of the Radio-active crystals was incased in a piece of lead $\frac{1}{4}$ -inch thick. On the top of the folded lead two matches were placed with a sewing needle resting between,

PLATE No. 8.
PHOTOGRAPHIC EFFECTS.

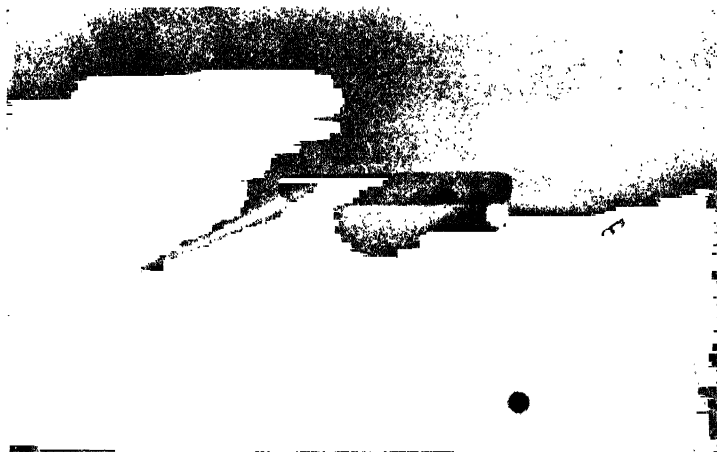


FIG. 1.

*Reprinted from Brighton and Hove Society, June 4th, 1914.
Photo by A. E. Souch, Hardeastle & Co., East Street, Brighton.*

This Photograph shows the Effect produced upon a Photographic Plate, wrapped up in a Black Paper packet, upon which a Glass Tube containing some of Mrs. Dickinson's Crystals (extracted from the Dongor Oils) had been placed, and so left in the Dark for apparently about 63 hours. (See Article, page 68.)

NOTE. The above Shadowgraph clearly shows the Image of the Glass Tube, photographed *through* the Black Paper, by the Rays emitted from the Crystals *within* the Tube. (Ref. page 66, line 17.,



and put on top of the two matches was the photographic plate. The whole was then placed in a closed wooden box and left in the dark for about twelve hours; and upon the photographic plate being developed by the photographer, a clear (though, of course, slightly blurred) impression of the sewing needle was found on the photographic plate, in accordance with the position in which it had been placed. This result showed that the "rays" from the radio-active crystals had penetrated the glass tube and the covering of lead ($\frac{1}{8}$ -inch thick), and photographed a "shadowgraph" of the sewing needle upon the plate raised on the matches above. (See Fig. 2.)

In more or less similar ways photographs from these crystals have also been obtained through sheets of aluminium. (For reference to these experiments, etc., see the *Brighton Graphic*, November 11, 1915.) The photographer who conducted this experiment has assured the writer that there was no mistake in the result obtained, and has given a report to that effect. (See page 165.)

From this last experiment, then, we see that the "rays" from the "New Activity" are capable of penetrating lead, and beyond number are the numerous other satisfactory photographic experiments which the discoverer has herself obtained, proving the presence of "penetrating rays" from her crystals.

Later, in October and November, 1918, Mr. W. W. Baggally independently carried out some photographic experiments with Mrs. Dickinson's crystals. As an expert, he took every precaution to avoid anything faulty, and was careful in having perfect plates, sound black paper, etc., and the experiments were conducted where any results arising from "induced radio-activity" from the crystals or the surroundings could not affect the experiments. He also used a "controlled plate" in all experiments (that is an identical one, and under all the same conditions, with the exception of the absence of any "radio-activity"); which, of course, was a blank, and gave no results. His experiments only confirmed what had already been found.

By placing one of Mrs. Dickinson's radio-active crystals in a sealed glass tube upon a photographic plate,

wrapped up in black paper, he obtained decided results of “fogging” after 36 hours’ exposures. Repeated experiments have given the same result. (See Fig. 3.)

In another case he obtained, upon a photographic plate wrapped up in black paper, the faint outline of the image of the glass tube containing the radio-active crystal resting upon it (*i.e.* the plate) in a 36 hours’ exposure, which, since the result was faint, was probably not long enough.

And, finally, he was able to obtain upon a plate wrapped up in black paper the faint outline of the image of the glass tube containing the crystal *through a lead box* $\frac{1}{8}$ -inch thick (which had been specially designed by Mrs. Dickinson), the box containing the tube having been placed upon a sensitive photographic plate and exposed for 4 days (? not enough). These photographs and results have also been published, some of them are here shown (see illustrations). Mr. Baggally’s photographic results were placed before an eminent authority on “radio-activity” for his opinion, who, after examining them, stated: “I should be glad to look into the radio-active material, but, of course, from the photos there is no doubt about the radio-activity,” etc.

So it was natural, since the results of the discoverer’s early experiments so strongly supported the presence of “radio-activity,” that it required the conducting of further and other tests being carried out to show this. Another important proof, showing the “radio-activity” of Mrs. Dickinson’s crystals, is that of the Spinthariscopes, next dealt with.

The Spinthariscopes.—This instrument, as previously described in the chapter on “Radium” (see page 6), was devised by Sir William Crookes. Its description and functions have been fully dealt with. In the early days following the discovery of Radium, “Spinthariscopes” were among the chief instruments used for detecting “Radio-activity.” As we know, a specimen of the substance to be tried is mounted on a little vane in the spinthariscopes. Upon visiting the dark-room and looking through the eye-piece, one is instantly able to discern whether the substance being tested possesses “radio-

PLATE No. 8.
PHOTOGRAPHIC EFFECTS (*continued*).

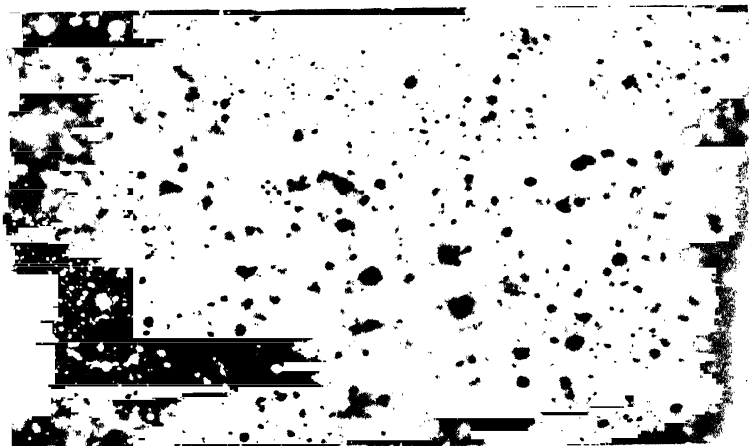


FIG. 3.

Fig. 3 shows "Fogging" on a photographic plate wrapped up in black paper, produced by a "Dickinson" Crystal contained in a glass tube, showing "Radio-Activity." Experiment independently carried out by Mr. W. W. Baggally, Scientist, and Investigator of the "Dickinson" discovery, November 2nd, 1918.

Exposure, 36 hours. (See Article.) (Ref. page 68, line 3.)



FIG. 4. •

Fig. 4 shows an Effect *produced* on a photographic plate wrapped up in a black paper, by a "Dickinson" Radio-Active Crystal, contained in a glass tube, placed in a box made of Lead $\frac{1}{8}$ (one-eighth) of an inch thick.

Experiment carried out by Mr. W. W. Baggally, Scientist, and Investigator of the "Dickinson" discovery, November, 1918.

Exposure, 48 hours. (See Article.)

activity." If the substance emits "a" (alpha) rays (*i.e.* Helium atoms), these become distinctly visible upon striking the zinc-sulphide screen at the base of the instrument, appearing as a series of very rapid little bright greenish-white sparks, or points of light.

And so, when a new substance was produced which was claimed to be "radio-active" (though it was not observed to be recognisable among the familiar radio-active elements known), it was only natural that scientific men upon being questioned, and one in particular, were sceptical; but one and all wished it to be tried in a spinthariscopes, which, they said, would definitely show whether it possessed "Radio-activity" or not.

And it was following this advice that the discoverer immediately visited the firm of opticians referred to, purchased a new and unused spinthariscopes, and had one of her samples mounted. Without repeating what has already been said, the result was that the "New Activity" immediately showed bright "scintillations" in the instrument. This satisfactory result, followed by the photographic experiments mentioned above, more than ever strengthened the claims and reality of a new Radio-activity. Several spinthariscopes were then mounted, all showed "scintillations" characteristic of Radium. These spinthariscopes have been shown to some of our leading scientists repeatedly, and they are satisfied that there is "Radio-activity" present. A spinthariscopes was sent to Sir William Barrett, F.R.S., for inspection, and he says: "We tried the spinthariscopes and were most successful when it was properly focussed, and we had been some time in the dark; the sparks were quite distinct, and the effect the same as a particle of Radium bromide; but whether the effect was due to radium or not I had no means of knowing." (Ref.: extract from letter, May 1, 1917.)

These spinthariscopes, when inspected at any moment during the past few years, have never failed in showing "scintillations." The writer can certify this; he has repeatedly seen the "scintillations," and when asked to do so, has often taken his spinthariscopes to pieces and satisfied himself and others that the spinthariscopes

contain nothing but the ordinary samples of the “ New Activity,” as discovered by Mrs. Dickinson.

Nevertheless, we must remember that a spinthariscopes, should it at any time in the past have contained particles of Radium or Thorium, etc., would be so impregnated with “ radio-activity ” as to continue showing the scintillations, even long after their removal.

This fact was naturally suggested among the possibilities which could account for “ activity ” being present in Mrs. Dickinson’s spinthariscopes. But this theory is once and for all ruled out by the fact that the spinthariscopes supplied were *brand new ones*, and, as the makers certify, had *never* contained or even been in the vicinity of Radium or any other radio-active compounds.

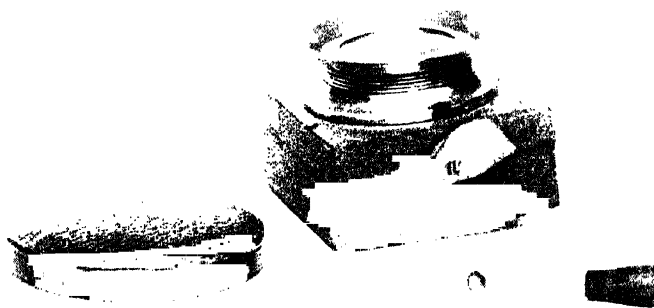
From this proof the conclusion we deduce is that the “ New Activity ” is either genuinely radio-active, as claimed, or that it had been rendered “ radio-active ” some time in the past, and had been able to retain this property *throughout several years*, while “ induced radio-activity ” from mineral Radium does not last so long.

This latter fact will be fully dealt with later. But it is quite sufficient to add that the discoverer is prepared at any time to mount any selected crystal of her substance for inspection, since she knows the result would be the showing of scintillations. Another eminent British scientist (*i.e.* Sir Oliver Lodge) pointed out that even if a form of “ induced ” radio-activity had been successfully imparted to these particles, that it would only be superficial, and that by filing down the outsides of one of the crystals, and thus obtaining only a minute “ core,” the “ imparted radio-activity ” would be then destroyed. And thus, should the “ core ” still show activity, then the theory of it having been treated by induced radio-activity would no longer hold good. Here again the discoverer has been, and is still, open to any such tests.

So from the above remarks we see, firstly, that the “ New Activity ” shows scintillations in *new* and *uncharged* spinthariscopes, and secondly, that its activity is not due to any previous treatment or contact with inorganic Radium, but to its “ own ” properties.

Incidentally the writer is able to independently confirm,

PLATE No. 9.



*Photo by F. J. Tanner, St. James's Street, Kemp Town,
Brighton, 1918.*

THE WRITER'S HOME-MADE SPINTHARISCOPES.

The above photograph shows the writer's home-made Spinthariscopes. It is extra large (size 2 — 2 ms.), and is made of wood, with the view that there would be less danger of faulty results arising from "induced" or vitiated activity, than when made with metal. The magnifying lens is powerful, and perfect focus can be obtained by the screw adjustment.

The Spinthariscopes has been specially designed so that the zinc-sulphide screens can be easily replaced. Any Crystals to be tested can also be readily and instantaneously mounted, through the doorway provided, *at the exact moment* when one is actually observing the screen, and the effect which will be produced, by bringing the crystal near the screen in the dark-room.

The writer's own *test* crystal, which always produces beautiful bright scintillations, is seen ready for testing. All fear of Light entering the instrument is avoided by placing the cover on the top, and closing the doorway in the side, when not in use.

(Ref. page 74, line 25.)

from his own experiments, that Mrs. Dickinson's crystals produce "scintillations in a spinthariscopes," since he designed and made himself a new *test* spinthariscopes at his own residence, for which he purchased *new* zinc-sulphide and prepared his own screen; and the spinthariscopes when finished was kept where no "induced radio-activity" could possibly affect it.

By a special arrangement of his own it was made possible to actually mount the crystal in the instrument at the exact moment when one was in the dark observing the screen. In his experiment, directly the specimen (from the Dickinson crystalline particles) was brought into position above the screen, bright scintillations appeared immediately—they have continued to do so ever since.

The screen, however, has now become so vitiated from the "induced radio-activity" from the original crystal, that although it (*i.e.* the crystal) has not been in the spinthariscopes for about four months, the screen still scintillates as continuously and as brightly as ever; which shows that not only do the crystals emit "radio-activity" of a powerful nature, but that they have also produced a strong effect of "induced" Radio-activity in the instrument.

The accompanying photograph shows the writer's home-made Spinthariscopes.

"Radio-Activity," its Luminosity observed through Copper.—This experiment is mentioned for purposes of comparison with those results obtained from inorganic Radium. Pure Radium Bromide (as stated on page 8) will light up a screen, which can be seen through several copper coins. In this respect the "New Activity" is not (without the Spinthariscopes) independently luminous, like Radium, so consequently the discoverer has been unable to obtain any such results.

This fact, though in a way unsatisfactory (since the "radiations" from the "New Activity" are similar to Radium in so many other ways), certainly draws a distinction between the properties of Mrs. Dickinson's radio-activity and those of Madame Curie's mineral Radium.

Lines, Markings on Glass, etc., caused by the "New Activity."—During the observations made upon some of

Mrs. Dickinson's crystals under the microscope, curious lines and markings had been noted on some of the glass slides. In the early stages of the research not much attention was paid to these, it being generally believed that these markings were possibly due to existing imperfections of or scratches on the glass.

W. W. Baggally, however, investigator of the Society of Psychical Research, for over a year had been paying special attention to these markings as detected under the microscope, since when commencing this work he had been much impressed by the “ analogy ” he saw between the “ Form ” of these lines on the glass plates (caused by Mrs. Dickinson's Activity) and between certain “ Trails ” produced in the “ aqueous atmosphere ” experiments with Radium, as carried out by C. T. R. Wilson, F.R.S., described later.

Now great difficulty was experienced in endeavouring to *prove* whether the “ New Activity ” *actually produced* markings on glass or not, and with a view to ascertaining and establishing this fact definitely, W. W. Baggally commenced a series of experiments, and was good enough to allow the writer to assist him.

On one particular occasion (see reports, E, of February 7, 1918, page 166) W. W. Baggally brought with him some perfectly *new unmarked* microscopic glass slides. Every part of these slides was thereupon minutely examined under the microscope, when they were found to possess no such lines or scratches.

A specimen of the “ New Activity ” was next placed upon one of these clear glass slides and examined under the microscope; the crystal upon the glass and the microscope then remained untouched but carefully watched for a short time.

Later observations of the crystal upon the glass slide were again made. This time the crystal was, of course, the same as before, but in the neighbourhood of it were well-defined deepish marks or indentations upon the glass slide, as if cut with a diamond.

These markings produced upon the glass slide always appear to follow some definite law, very often there appear to be :—

(1) Two parallel lines, very close together, clear cut and absolutely straight, while sometimes

(2) There are long straight lines with sudden branchings off near the end (note, these are identical in "*Form*" to those Trails observed by C. T. R. Wilson in his "aqueous atmosphere" experiments with Radium) (see accompanying photographs) . . . and as well as the last two mentioned kinds of lines, a third series has also been detected.

(3) These again seem to follow some known law. To describe them accurately in scientific words is difficult, but there is a series of them; these markings are always equidistant from one another, their positions parallel and their directions one and the same, there are several of them like a flock, they are of a misty nature, and their appearance is roughly egg-shaped, the small end finishing in a kind of straight tail.

In the particular experiment referred to, the *crystal produced these later lines as well as two parallel straight lines* (viz. No. 1 type) upon the previously examined unmarked glass.

W. W. Baggally (witnessed by the writer) conducted the whole experiment throughout under scientific test conditions, and the *lines were certainly produced by the "New Activity"* in their presence, nothing having been touched during the whole procedure. Both the crystal and the glass were *dry*, and all possibilities of any such results having been obtained artificially were carefully guarded against and ruled out by Mr. Baggally.

So, from this experiment carried out under test conditions, it *conclusively proved* the long-believed theory, that the "*New Activity*" possessed this *property of marking glass* in the unusual manner referred to.

W. W. Baggally pays the greatest attention and importance to the similarity between certain of the lines (*i.e.* No. 2 type, which are produced sometimes) and to those trails in "aqueous atmosphere" caused by Radium.

The marked glass slides were removed and preserved, as W. W. Baggally, who had been in correspondence with one of our most eminent scientists respecting the "*New Activity*," intended to send some of these glass plates (on which lines had appeared) for his examination. But

before doing so it occurred to him (Mr. Baggally) to re-examine the plates under the microscope, which he carefully did, and to his great surprise he found that the *lines had disappeared*.

He therefore tried fresh experiments, obtained new lines, kept these plates for a short time, and found that these lines had also disappeared. He wrote to the Professor referred to, gave an account of his discovery of the lines and of their disappearance, and received a reply from him, in which he says, among other statements :—

“ What you say about the lines on the plates is interesting. It suggests that the action takes place in the ultra-microscopic film of moisture or condensed air coating the surface of the glass, rather than in the glass itself. Indeed, in the glass itself, ‘radio-active’ lines would be very short, as you know from Joly’s paper, but in the superficies they would be longer. It is important to measure their length. They usually terminate abruptly. . . .

“ The phenomenon, being evanescent, rather increases its interest. . . .

“ These lines that you speak of may be expected to give much more definite information than mere scintillations, and, moreover, the information may be of a quantitative kind . . . ”; and he concludes by suggesting plans to make the lines permanent.

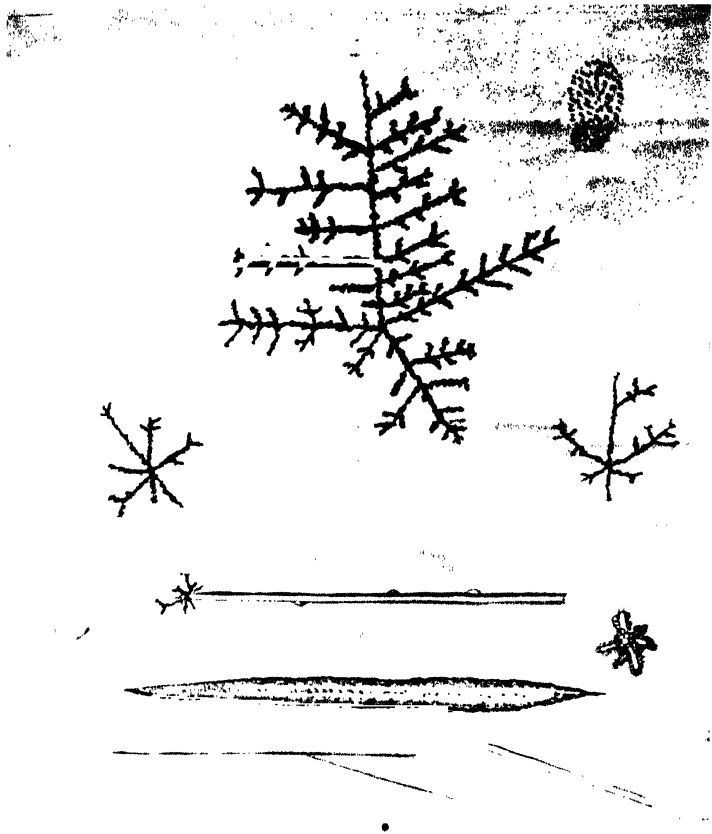
It has been decided to term the markings of the “ New Activity ” the “ Baggally Lines,” on account of his firstly observing these particular lines and their *analogy in form* to those “ trails ” obtained with Radium as mentioned.

Other curious markings and designs resulting from this “ New Activity ” have also been preserved and photographed, and can be inspected any time. (A few diagrams of these are here given, see Plate No. 10.)

And now as to the cause of the production of those trails in “ aqueous atmosphere ” caused by Radium.

C. T. R. Wilson accounts for them by the following reasons: He says, “ The ‘ alpha ’ ray (*i.e.* a Helium particle) in its course collides with the atom of the air or gas, and in striking the atom causes ‘ ionisation,’ setting free negatively-charged electrons from it. These negative electrons then are able to attract around them moisture,

PLATE No. 10.



*From a Drawing by Mr. W. Wortley Bagdall.
Photographed by F. J. Tanner, Kemp Town, Brighton.*

CURIOUS MARKINGS AND DESIGNS ON GLASS.

NOTE.--The above is an example of many of the curious lines and markings, which have been found to be produced upon glass plates, by Mrs. Dickinson's "Radio-Activity." (See Article.)

(Ref. page 74, line 33.)

and become the nuclei of little vapour drops, which become visible for the time being, and which show the path that the 'alpha' ray has traversed."

And now, by exposing this cloud of water drops to an instantaneous illumination of great intensity, say, from a Leyden Jar discharge, at the exact moment when the photograph is taken, it is thus possible to secure a record of the water drops in the positions which they occupied immediately after their liberation by the "ionising" agent.

Thus the photograph gives us the invisible trail of "ions" left behind along the course of any ionising particle, since it (the invisible trail) has become converted into the visible line of cloud, which we have photographed.

Professor J. Joly admirably describes this in brief, by saying :—

"Here the path of the ray has been rendered visible by the condensation of water particles under the influence of the 'ionisation,' the atmosphere in which the ray travels being in a state of supersaturation with water vapour at the instant of the passage of the ray." (Ref. : "Pleochroic Haloes," J. Joly.)

Now it is on account of the momentum of the "a" ray being so great that the straightness of its trail is caused. The branchings off near the end are owing to a rebound of one of the negatively charged electrons, which thereupon strike out and take up a straight course of their own.

Mr. W. W. Baggally's able article dealing fully with this subject is, by his kind permission, given in full on pages 147 to 156, and contains interesting photographs of these curious lines.

Hence, finally, we are able to arrive at the three following points :—

Firstly. That to produce on glass artificially and so rapidly these absolutely straight lines with a sudden branching off, all of which are "microscopic" in the case of this "New Activity," would be quite impossible.

Secondly. From the fact that the "New Activity" produces these lines in this way, it may be seen that it affords us possibly a *new* ocular *method* of being able to trace the route taken by the "alpha" ray . . . and

Thirdly. That with the “ New Activity ” these lines are probably due to its “ alpha ” or some corresponding ray ; but we must not say this for certainty.

The “ New Activity ” and the Electroscope.—Among the chief tests for “ radio-activity ” the electroscope plays a great part ; in fact, so important a part as to its not only being used for showing the least trace of activity, but also by its being the instrument best adopted for determining the “ degrees in strength ” of the preparation. We have said before, when referring to the electroscope in the “ Radium ” chapter that even an infinitesimal particle of Radium can be easily detected and measured by its means.

The electroscope (see page 7) may, for those unacquainted with it, be briefly described as follows : It consists of a glass jar, which is mounted on a small wooden platform or base. In the neck of the jar is a large shellaced cork or insulated piece of wood. In the middle of this there is a hole through which passes a brass rod standing vertically, having one end above the cork and the other end in the middle of the jar. At the top end of this rod, outside the jar, is a round horizontal brass stage, about 3 or 4 inches across, while upon the other end of the rod (namely, that end within the jar) are hung side by side two very thin gold-leaves.

The function of an electroscope is to demonstrate the presence of an electrical charge. We know from the “ law of induction ” in electricity that upon bringing an electrically charged body into close proximity to another uncharged body, that the first charged body “ induces ” upon the second body an electrical charge of the opposite kind to itself. And so, upon bringing a body of a known electrical charge (say a positive one) to within close proximity of an electroscope, the charged body imparts to it an “ induced ” charge of a negative sign. This charge is, of course, conducted from the brass stage down the rod to the gold-leaves, and since both the leaves receive at once a charge of electricity of the same sign, they are by the “ laws of induction ” repelled ; hence the leaves “ diverge ” or fly apart, indicating that the electroscope has received an induced electrical charge.

Now it was found, when upon bringing *some* of the crystals of the "Dickinson New Radio-activity" within close range of the stage of a *charged* electroscope, that the already diverged leaves instantly fell, recording that the electroscope had become *discharged*.

Radium is able to discharge an electroscope even through an inch or more of zinc or iron, and thus, knowing the quantity of Radium, its distance from the brass platform, and the time taken to discharge the leaves, the purity per cent. of the salt can thus be estimated; and, as we stated before, the rays "emitted" from a highly active preparation of Radium Bromide will discharge a charged electroscope immediately. (The scientific reason for this is explained, page 24, see footnotes.)

Hence it can be readily seen from the above remarks that the electroscope forms one of the important scientific instruments for showing "Radio-activity." And so, in the case of the "New Activity," the electroscope was one of the first real scientific tests which Mrs. Dickinson employed for determining whether her crystals emitted "radio-activity." The photographic and spinthariscopes experiments, also made to prove this, have already been mentioned. Here again with the electroscope the same results as with Radium were obtained, which still further confirmed the presence of "Radio-activity."

The author himself, in front of many witnesses (*i.e.* see report, page 167), has most carefully tested this, and has found that upon bringing tubes containing *some* of the specimens of the "New Activity" near to a charged electroscope, that the electroscope becomes discharged. As the sample of the Dickinson Radio-active substance in question is lowered towards the stage from a height, the leaves close together correspondingly. In many cases, probably when using a stronger preparation, the diverged leaves have collapsed instantaneously. The writer has found this to be the case, whether the electroscope be charged either positively or negatively; but from his own experiments he is of the opinion that the electroscope when positively charged is discharged more rapidly than when negatively charged. While incidentally the experiments have shown that the thickness of the glass tubes

containing the crystals seems to make no difference to the result.

The electroscope, like the spinthariscopes, which is regarded as a good criterion for “ Radio-activity,” should be viewed with the greatest importance, since it proves a clear indication of powerful radio-active rays being emitted by some of Mrs. Dickinson’s crystals.

The “ New Activity ” and its Effect upon Ice.—Radium is always evolving heat, and its temperature has been found to be a little higher (Rosecoe says 2° C.) than that of the atmosphere surrounding it. This fact and its cause has been dealt with previously, on page 10. However, we may mention, quoting from a standard work, that the “ heat evolved ” by one gram of Radium during its lifetime has been calculated to evolve in heat units one thousand million, that is approximately one hundred gram calories per gram per hour, but which, if it were suitably converted into work, would raise five hundred tons of matter one mile. . . .

This tremendous energy can be fully realised when we remember that one gram of our best fuel, Hydrogen, when burned in Oxygen would only give thirty-four thousand heat units, which is approximate to one-thirty-thousandth part that of the output of Radium. Yet from a small weight of Radium, the Radium energy was found during a period of four years to be three hundred times greater than the energy given by coal from the same weight (*i.e.* Carbon being chief constituent).

And still here again the Dickinson crystals possess this same characteristic property of Radium. Namely, small particles of the “ New Activity ” were found to have a melting effect upon “ ice ” when placed upon it by the discoverer, and in all probability its proportion of heat may be about the same as that of Radium. This experiment has been more successfully tried upon a large scale than upon bench test-cases in the laboratory. Quantities of water have from time to time been successfully treated by the “ New Activity ” and rendered “ radio-active.” One of these samples of ordinary water made “ radio-active ” was submitted to a temperature below freezing (such as 27° F.) for a period of twenty-four hours (see

report, page 168). At the same time, and under identical conditions, an equal quantity of ordinary water in a similar vessel at exactly the same temperature was also tested. At the end of twenty-four hours the samples were removed for inspection, the result being remarkable; the ordinary untreated water was found to be a block of ice, the other sample of ordinary water, but rendered "radio-active," remained liquid, containing a very few minute particles of ice floating about in it.

On another occasion an experiment was tried, more for the sake of curiosity than anything else, to see the effect of "radio-active" water upon "ice." It was during a very cold spell of wintry weather that ice, which had been found frozen on the water pipes outside Mrs. Dickinson's house, was collected, and about equal quantities placed in two buckets; ordinary cold water from the tap was poured into one bucket, and into the other bucket was poured the same water, at the same temperature, but which had been treated with the "New Activity." The result of this experiment showed that the ordinary cold water poured upon the ice had no effect, while the "radio-active" water which had been poured upon the ice in time melted it.

From the facts as in experiment one, that the crystals of the "New Activity" have a melting effect upon ice similar to that of Radium, and again, as in experiment two, where Radio-active water was capable of resisting to a degree the action of freezing, and from experiment three, where lastly Radio-active water began to melt the ice, we have been able to draw the conclusion that the "New Activity" "evolves heat," which, as we have already pointed out, is a strong characteristic feature, forming yet another link between the similarity of its properties and those possessed by Radium.

The writer has no hesitation in mentioning that he has conducted some of these experiments himself, and in the case of experiment number two he was both surprised and sceptical at the result of the Radio-active water being unfrozen, and to satisfy himself perfectly he analysed the water, thinking possibly that it might have accidentally contained a small percentage of alcohol or

glycerine, etc., which in the ordinary course would have assisted in lowering the freezing point ; but the water was found to be normal chemically in every respect, with the exception of its treatment due to the “ New Activity,” which seems to suggest that it (*i.e.* the “ New Activity ”) causes some “ physical ” change in the water.

Incidentally with regard to the experiments upon *water treated with the “ radium emanation,”* the writer has been unable to ascertain what results have been found in this respect, beyond the one mentioned by Sir William Ramsay, when he states that the water gave “ Neon ” as well as “ Helium ” ; while in the case of water treated by the “ emanation ” of the “ New Activity,” the discoverer is of the opinion that it gives Ozone.

This fact (*i.e.* the “ New Activity ” evolving heat, and thereby reducing freezing points), besides being of great scientific interest, may be the promise of great possibilities in the commercial world, and a few suggestions on this will be put forward later on.

The “ New Activity ” and the Microscope.—The nature of the work done with the microscope it is not possible to describe, but throughout all the research the microscope has been referred to at every step, and has been an un-failing guide. It has been consulted for purposes of comparison and analysis, and much of the examination as to the nature of these “ crystalline ” particles has necessarily been accomplished with its aid. The microscope, though used when inspecting the various substances handled from time to time, has in itself afforded no definite tests for “ radio-activity.” The one great important point, however, revealed by the microscope, has been in the discovery of certain lines or markings upon glass caused by Mrs. Dickinson’s crystals. Their similarity to the “ trails ” caused by Radium salts in the “ aqueous atmosphere ” experiments has already been drawn attention to.

The microscope has also been essential for obtaining many microphotographs, either of the effects produced by, or of specimens of the Dickinson “ radio-active ” crystals. These microphotographs are of great scientific interest, and may turn out later to be of importance and value, to

PLATE No. 11.



A CURIOUS RADIO-ACTIVE EFFECT.

The above curious photograph was the result of photographing a tiny "Dickinson Radio-Active Crystal," in the centre of a piece of white paper, through the Microscope.

The effect of the Activity can be observed.

(Ref. page 80, lines 40, 41.)

say nothing of their forming a beautiful and original collection.

The "New Activity" and the Skin.—It was the fact that Radium was found when in close contact with the skin to burn it, which led to its being used in therapeutics, and to its being tried especially in Cancer cases.

Mrs. Dickinson has also found that the "radiations" from the "New Activity" burn the skin, though its effect is nothing like as rapid or as violent as that produced by Radium. In fact, the discoverer's hands to-day still show the marks of where she was once burnt by the "rays" (emitted from one of her highly active preparations) during the early days following her discovery. The chief point to observe being, as the discoverer says, that it is not till after applying a tube containing one of the crystals to the skin for a *long time* that a small burn then appears with a surrounding ring; these in time both disappear and heal up, leaving absolutely no detrimental effect, such as "radium dermatitis."

Great strides have already been made with the "New Activity" in this respect, and its use in therapeutics will be dealt with under "Antiseptics." (See page 100.)

The "New Activity" as a Cleansing Agent.—The "New Activity" seems to possess one very remarkable property, which, for want of better words, may be described as having an "affinity for impurities." This, as will appear from a scientific point of view, is very difficult to explain. However, it may be said that when dirty water or oil or many other substances are treated with the "New Activity," the impurities resident in them seem to be automatically precipitated out. This would, in general, on the face of it, suggest a tendency for liberating Carbon (*i.e.* where present); and in cases where the "New Activity" has been used in Medicine and applied to open wounds, it has been found to be of great use as a cleansing agent; in the sense that wounds become firstly cleansed, and secondly healed, the pus or discharge being freely liberated and expelled. Great use has been made of this fact, as we shall see in "Antiseptics," and it is only mentioned here by way of pointing out what is meant by its "affinity for impurities," as the discoverer so calls it.

The “New Activity,” its Chemical Properties.—Little can be said under this heading, as though much work has up to the present been carried out, the discoverer has not yet come to a definite conclusion as to the category in the chemical world into which her work falls. When better understood a full report on this matter will be placed before scientific circles.

Analysis on the said crystals has not yet exactly shown their nature. The substance has been referred to as crystals; undoubtedly “crystalline particles” or “crystalloids” would have been a better term.

From the specimens examined by the writer the Specific Gravity is approximately 1.6 at 60° F.

The Specific heat is . . . and, in the event of its being a new element, as has been suggested, then its Atomic weight would be approximately. . . .*

Since Mrs. Dickinson’s substance emits “active rays” similar to Radium, it would naturally suggest its being one of the known “radio-active” elements; yet some of its other properties do not always correspond with this suggestion. Hence, the discoverer declines for the present to make a full chemical report, but will do so when her research and investigations are duly completed.

The substance is insoluble in water, ether, ammonia, and in nitric, sulphuric, hydrofluoric, and hydrochloric acids, etc., and so far no action has been found upon it in connection with the acid group as yet experimented with.

At high temperatures it does not appear to fuse or oxidise, and a chemist (*i.e.* Mr. Keeble), who tested a crystal to see if it was organic, stated that it carbonised. (If this is so, then it cannot be a new “element.”) Experiments with it in the electric-arc are still being carried out.

As mentioned before, its appearance is like that of glass, diamonds, or mica; but the early analytical work contradicted its being either or any of these.

When a tube containing the “New Activity” is brought near diamonds, so Mrs. Dickinson says, it renders them slightly more brilliant; and diamonds and other precious

* Owing to conflicting results in the Author’s estimations—in spite of great care—it will be necessary to repeat the experiments. These fresh figures were not to hand at the time of going to press.

PLATE No. 12.



AN EFFECT PRODUCED IN GLASS.

The above photograph is a microphotograph considerably enlarged.

It shows an effect which was produced on a glass plate by one of Mrs. Dickinson's "Radio-Active" Crystals.

The details concerning this curious "Star-Like" Effect are dealt with fully on page 83.

The "Original" marking on the glass plate can only be seen (and photographed) through the microscope.

The extraordinary originality, and rare beauty of this "hexagonal feathery" effect, can only be best appreciated by examining the photo under a small lens, or magnifying glass.

(Ret. page 83, line 38.)

stones which to a certain extent had lost their colour, after treatment with this "New Activity," regain their brightness. This quality is again akin to that of Radium.

Many of the other chemical properties of this "New Activity" are dealt with individually elsewhere; as, for instance, its photographic, electroscopic, and spinthariscopic effects, its rays, emanations, etc., while many of its undoubted properties are described in the commercial chapter, *since it was in the dealing with these business items that certain of its properties were observed, and they can only be recognised by its peculiar action or effect in those specific cases.*

It has been stated that the crystals from this "New Activity" have a curious "marking effect upon glass." In many cases they have been noticed to have the effect of cracking or breaking the glass tubes in which they have been placed. This also has been found to be the case with particles of Radium, the reason for which we have already given (see page 7).

Another curious property of "Radium" is that it gives the sensation of light to the human eye, even through closed eyelids, when brought close enough. The writer has himself on one occasion experienced this same effect when experimenting with one of Mrs. Dickinson's radio-active particles.

The writer is just about to examine the flame test and spectrum of this "New Activity" with a spectroscope, so it is impossible to publish the results here.

The "rays" from the crystals of the "New Activity" have a very curious effect upon water, which is fully dealt with elsewhere.*

Upon Tin a strong and destructive action has been observed, and in a few cases glass plates, which have been subjected to the bombardment from its "rays," have been found to show most curious microscopic designs similar to crystallisation.

On account of their originality, some of these designs, peculiar star-like effects (see Plate 12), were sent to one of our most eminent scientists, who, besides being a

* See pages 88 to 90, and 95.

Physicist, is a Geologist and a Crystallographer as well, for his inspection and opinion as to what they were. An extract of his reply is quoted, in which he says:—

“They are certainly not Haloes (meaning Pleochroic Haloes), and must be formed in quite a different way. Is it certain their origin is radio-active? They resemble crystals such as would be found in a precipitate. Mr. Baggally does not say anything as to the appearance or origin of the radio-active crystals which are said to produce them. *Quite possibly a crystallisation of the glass itself might be initiated by (radio-active) rays, but such has, so far as I know, not yet been observed.* . . .

“I return the photos, quite unable to form any opinion as to what they actually represent. Crystallisation may be produced in so many ways. . . .”

So from the above reply we see that these curious markings on the glass referred to were evidently not recognised as any known form of crystallisation by an eminent crystallographer; and as they are in reality purely “effects” produced instantaneously *in the glass itself* by the “rays” from Mrs. Dickinson’s crystals, it will be clearly seen that they are *not* the result of any “crystallisation which would be found in a precipitate.”

As the Professor suggests, quite possibly they are a *crystallisation of the glass itself*, caused by the “rays,” but which, as he points out, has probably not been observed before.

Another very remarkable property of Mrs. Dickinson’s crystals was observed by W. Baggally (Junr.) after exhaustive experiments. He states:—

“He found that a *sealed* glass tube of known weight containing one of Mrs. Dickinson’s crystals *gradually lost in weight* when accurately weighed on a balance from time to time. He states further that the loss in weight was proportional to the number of days, and that there was no error in the experiment. All the weights were checked, and he was assisted by W. W. Baggally, who also certifies to the accuracy of the experiment.” (See report, page 168.)

Now, as it was the *same* glass tube throughout the whole experiment, and which was *hermetically sealed*, it is obvious that it cannot have *lost in weight* by simply

remaining on the balance pan within a closed case. Again, as the tube was hermetically sealed (no porous corks, etc.), it follows that no particles or gaseous matter could have passed away from the crystal *through* the tube, and thus accounted for the loss in weight.

Consequently, if the experiment is without fault, then the only solution there can be is that the crystal in continually throwing off "rays" is meanwhile undergoing some form of transmutation, and thus dropping down in atomic-weight.

Unfortunately the loss in weight has been so excessively appreciable in the time as to suggest a very rapid decomposition.

Although the writer (who is fully conversant with the facts of this case) sees no evidence to suggest any inaccuracy on the part of the investigators or their instruments, he feels that this experiment requires to be repeated and independently confirmed.

Another most original property of the "New Activity" is claimed by Mrs. Dickinson, who says "that her 'radio-active' crystals are able to take on the colour of other substances close at hand"; in other words, these crystals seem to possess the extraordinary property of having an "affinity for colour," and in time taking on the colour of an adjacent object. It is difficult to describe this curious phenomenon in words, but we do see this perhaps same "force" at work in certain animals which are said to possess the "protective powers of mimicry."*

In concluding the chemical properties, as outlined before, it may be a known element or compound possessing an "activity" hitherto unrecognised, or it may be a known element or compound which the discoverer has succeeded in rendering capable of possessing, and of retaining a high "radio-activity," and with which, by making use of this fact, she has been able to apply it advantageously for use in the commercial world.

The Rays of the "New Activity."—The "New Activity" "emits rays" of at least two different kinds; possibly it

* If the theory regarding the formation of the crystals, as suggested on page 65, is true, then it should be more easy to find a reason to account for this latter property.

“ emits ” three rays, as Radium, or it may give off even more, as yet unidentified. Whether its rays are correspondingly identical with those of Radium is a matter which has yet to be proved ; and whether the terms “ alpha,” “ beta,” and “ gamma ” are to be suitably applied to these rays as well, or whether these terms are to be limited only to the rays “ emitted ” by the different known “ radio-active ” substances, however varying, is also a point which will have to be determined later ; but at the present, for the sake of convenience, we will refer to the rays “ emitted ” by the “ New Activity ” under the names of “ alpha,” “ beta,” and “ gamma,” as these are now widely known in connection with Radium, Thorium, Uranium, etc.

The “ a ” (alpha) Ray of the “ New Activity.”—That this substance, known as the “ Dickinson New Activity,” “ emits ” what are either “ a ” rays, or a ray corresponding to them, is illustrated by the fact that the crystals give bright “ scintillations ” upon the zinc-sulphide screen in the Spinhartoscope. These, we know, are produced by the Radium “ alpha ” rays.

The same reason (see p. 6) which accounts for the “ alpha ” rays of Radium becoming luminous scintillations upon striking with their great velocity the zinc-sulphide screen probably holds good in the case of the “ alpha ” rays “ emitted ” by the “ New Activity.”

The velocity at which these “ alpha ” rays (of the “ New Activity ”) are radiated has not yet been accurately estimated.

Mrs. Dickinson considers the “ alpha ” rays emitted by her substance to be of a penetrating nature, while the behaviour of the “ New Activity ” rays with regards to their deviation in a magnetic field is just about to be gone into.

In the respect of penetration mentioned above, they would appear to differ from the Radium “ alpha ” rays, since the discoverer (which must later be determined by experiment) even claims that she has known them capable of passing through thin sheets of brass or copper, which, as we know, the Radium “ alpha ” rays are unable to do, although the “ beta ” and “ gamma ” rays can.

The "b" (beta) Rays of the "New Activity."—Whether the "New Activity" possesses only a second ray besides its first or "alpha" ray, or whether possibly it possesses both a "beta" and a "gamma" ray, either separately or in conjunction with one another, it is difficult to state; but, apart from its "alpha" ray, it certainly seems to possess at least another different ray.

"Alpha" rays of Radium, as we know, give scintillations, but these rays are easily absorbed by such things as glass, aluminium, or mica. Now the Dickinson "New Activity" "emits" a ray which is *not* absorbed by even thick glass. This has been concluded from the fact that particles of the "New Activity," though in sealed thick glass tubes, are able to "emit" an "activity" acting *outside* them. This result then would either suggest that they (*i.e.* the particles) radiate powerful "beta" rays, or even still more penetrating ones, possibly "gamma" rays.

In the case of Radium, we know that most of the curative results obtained by it in therapeutics are said to be due to its "beta" rays, on account of their penetration; and since the "New Activity" emits rays which also indirectly give curative results in medical practice, this would strongly support the theory that the New Activity possesses "beta" rays more or less similar to those of Radium, as well as its "alpha" ray.

As with Radium, these "beta" rays are considerably more penetrating than the "alpha" rays, and are in all probability responsible for the photographic action obtained *through glass* with the New Activity.

The "g" (gamma) Rays of the "New Activity."—From the fact that the New Activity "emits" a ray which is capable of passing *through "lead"* (*i.e.* as described under photographic results obtained through lead box, refer back to p. 68), we see conclusively that it possesses a *strongly penetrating ray* in addition to its "alpha" ray.

Now whether this ray, which, as the discoverer tells us, and which has since independently been proved, will pass *through lead*, is a "beta" ray of a very penetrating

nature, or whether it can be classed as a "gamma" or third and distinct kind of ray, is not yet known.

However, we remember from the Radium chapter that "gamma" rays only and always accompany high velocity "beta" rays. So consequently if the "New Activity" "emits" high velocity "beta" rays, "gamma" rays are probably produced as well.

Of the rays of the "New Activity" there is one point in common, so Mrs. Dickinson states, and that is that none of them have yet been found capable of penetrating wood.

The writer anticipates shortly conducting an active research into all the "rays" emitted by the "New Activity," and hopes with the means of electrical methods, and by employing different metals, as filters, etc., to individually separate out and distinguish the rays, and to examine their velocities and properties.

The "New Activity" Emanation.—The "New Activity" appears to evolve a gaseous emanation. No doubt the theory to account for this is the same as that which has been put forward to explain the "Radium Emanation." (See pages 12 to 15.)

Little is known as yet of the "New Activity" emanation, though it would, however, seem to have some chemical activity. Tubes of glass, lead, brass, or porcelain, etc., containing the "New Activity" upon being placed in water immediately set up a decided action in the water. These tubes become coated with gaseous bubbles on the outside, as also do the walls of the receptacle containing the water, while the water itself becomes impregnated with these gaseous bubbles, and resembles in appearance "aerated water."

In other words, the substance, which we have called, for want of better words, the "New Activity," though completely incased within closed tubes, seems to produce an effect upon the matter *outside* the tubes, the action with water being the formation of a gas. The gas in question may be either liberated "nascent" Oxygen, due to some effect which the "rays" must possess in splitting up the water, or the action of the "New Activity" upon the water may result in the formation of Ozone.

From the "freezing" experiments with water and

certain other effects the writer would infer this to be the case, but it is only a suggestion, and is not claimed as a scientific fact.

On the other hand, in the case of Radium, water was found by Sir William Ramsay, when treated by the "Radium Emanation," to give Neon and Helium. Whether these two gases are also produced by the "New Activity" has not yet been determined, owing to the extremely minute * quantities of "emanation" obtainable, and to the lack of the delicate apparatus required.

Water when treated by the "New Activity" (*i.e.* the *modus operandi* being to suspend a tube containing the radio-active crystals in the water, and thus subject the water to the "radiations" from it) has been found to possess many extraordinary properties when used in conjunction with certain other substances.

This treated water, which behaves completely differently to ordinary water, is found upon the soap, electrolysis, and other analytical tests, to have apparently undergone no chemical change.

This fact at the time led chemists, who could detect no change in the water, to believe that the water was in no way different from ordinary water; but from their experiments with its action upon Ore, and Corrosion in boilers, etc. (dealt with later, pp. 124, 108), it was seen that the water possessed a strong and decided effect, and that its properties were different to those of ordinary water.

Consequently it is now supposed that this radio-actively charged water has in some way undergone a "physical" and not a chemical change.

These new properties of the treated water may be due to the "gaseous emanations" which are set up in it, from the tube containing the radio-active crystals.

For we know, anyhow, that gases possess a very peculiar chemical activity when in their "nascent" state, that is, at the moment of their formation, before the dissociated atoms have had time to unite into molecules, for it is only then that they can carry a negative charge. (Ref.: "Beyond the Atom," Professor J. Cox.)

* Only a few microns can be actually collected sometimes—a micron being the thousandth of a millimetre.

A pretty ocular demonstration of the actual effect that the “radio-active” crystals have upon water is very well portrayed by means of a “magic” or optical lantern. In the lantern a glass trough (or vessel of convenient shape) containing ordinary still water is arranged, and the image of it thrown upon the screen and observed. After a little while a sealed tube containing one of the Dickinson Radio-active crystals is lowered into the water and carefully focussed. Very shortly gaseous bubbles are observed, appearing as if they were growing on the outside of the tube containing the crystal. They gradually increase until the whole of the water is thus saturated, and assumes an “acrated-like” effect. Owing to the magnification of the apparatus upon the sheet the “charging-of-the-water” in this way makes a very illustrative and convincing experiment.

The effect of these gaseous bubbles in the water—either due to the “rays” or the emanations from the New Activity—is so great sometimes that if a hydrometer be placed in perfectly still water and then the tube containing the crystals be lowered into the water, the gaseous bubbles thrown out into the water from the tube are often so numerous that upon settling underneath the hydrometer they very considerably raise it up out of the water.

This experiment clearly shows that an “action” is being brought about by the “New Activity” in the water, and we may find by this method that it will be possible to judge when the water is fully charged, by observing the time taken for a certain weight of crystals to completely saturate a given quantity of water, assuming that the water is completely saturated when the hydrometer has risen to its zenith or highest point.

By brushing off the bubbles and replacing the hydrometer its original position is registered, showing that it has been the collection of the bubbles *under* the hydrometer itself which has raised it up, and not any alteration in the specific gravity of the water.

Another reason for believing that the Dickinson “New Activity” emits “emanations” as well as rays is from the fact, so the discoverer says, that it is able to impart “induced radio-activity” to other substances; since,

PLATE No. 13.



Photo by Tanner, Kemp Town, Brighton.

RADIO-ACTIVE WATER.

The above illustration shows a glass containing Ordinary Water that has been subjected to the "radiations" from a "Dickinson" Radio-Active Crystal. The latter is enclosed in a sealed glass tube and temporarily placed in the water.

The photograph shows the "aerated-like" effect produced.

as we know from Radium, that "induced radio-activity" can only be produced when "emanations" are present, the "induced radio-activity" consisting of "a," "b," and "g" rays, and being in the form of an "active deposit." (Refer back: pages 32 to 34.)

THE KNOWN RADIO-ACTIVE ELEMENTS, OR, A NEW RADIO-ACTIVITY? A COMPARISON.

In dealing with Radium in Chapter I. certain other radio-active elements were also included, and a table given (see p. 23) showing some of their properties and relationship to Radium.

Scientific men, who have seen the "New Activity" and who have not recognised it as the known inorganic Radium, have ventured to suggest it might be one of the other radio-active elements associated with the "radio-active" group.

In comparing the following few elements with the "New Activity," only their general fundamental characteristics have been laid stress upon. Owing to the atomic weight of the "New Activity" not having been definitely determined, this valuable scientific fact cannot be utilised for purposes of comparison. The supposition that the "New Activity" is "organic," as the discoverer claims, also cannot be used as an argument to show its difference to the "inorganic" radio-active substances, since the discoverer has yet to definitely establish whether her substance really is of an organic nature.

Also the facts that the "New Activity" can be obtained in comparatively large proportions, and that its "radiations" appear to be completely different in many respects to those known, and that its capabilities and properties enable it to do ever so much more than was ever even hoped of Radium (whose limited properties are apparently all known), are also, for want of verification, not made use of in supporting the following arguments.

Uranium.—(Refer back: page 23.) Among those first mentioned was Uranium, but from the chart given we see that though Uranium possesses "rays" it does not give "emanations," as the "New Activity" undoubtedly does,

nor is Uranium capable of imparting to other substances brought in contact with it “induced radio-activity”; and since the discoverer claims that she has from her crystals been able to impart an “acquired activity” to surrounding bodies, it would appear that her “active substance” is obviously not Uranium. Furthermore, the “New Activity” is not a pitch-blende constituent, nor is it found as lemon-coloured particles, as is the case with Uranium. And again, if the “New Activity” be proved to emit a “gamma” ray, it still more than ever dissociates it from Uranium, as Uranium does *not* possess a “gamma” ray. On account of the “New Activity” being once claimed to be “organic,” it was suggested, since it was supposed to be an “organic radio-activity,” that it might be Uranium Carbide; but from the above arguments it can be seen that this is not the case. Another point of difference between the “New Activity” and Uranium is, that though Uranium is capable of penetrating wood, Mrs. Dickinson says that the “rays” from her substance are not capable of penetrating wood.

So the suggestion that the “Dickinson New Activity” be Uranium is one which need not be further considered.

Thorium.—(Refer back: page 25.) Thorium was also one of the other radio-active elements mentioned in conjunction with Radium, and included in the chart on page 23. From the properties of the “Dickinson New Activity” we see that Thorium is the nearest in similarity to it. Thorium, it has been found, changes broadly into “Meso-thorium,” and this again into “Radio-thorium,” etc. (see plates in Chapter I.), whereas this has not been found to be the case with the “Dickinson Activity.”

Thorium is an element—*i.e.* inorganic—whereas the “New Activity” is claimed to be either an element or a compound, but which is liberated from organic substances, its origin being entirely different from that of Thorium.

Thorium demonstrates its activity by emitting “a” rays, which can be seen in the Spinharscope, but which are of a much feeble nature than the “a” rays shown in the Spinharscope by Radium.

Now experts who have handled Radium and Thorium in Spinharscopes, and who have also seen the scintilla-

tions produced by the "Dickinson Activity," say that it (the "New Activity") is far more powerful than Thorium; and one expert in particular (see page 166, for Sir William Barrett's report) considered it identical with the Radium scintillations in every respect. Meso-thorium "emits" "b" and "g" rays, which are only fairly penetrating. This again then cannot be mistaken for the "New Activity," as the "New Activity," as well as emitting "rays" of a *very penetrating nature*, emits in addition "alpha" rays.

Meso-thorium, being obtained in the form of meso-thorium bromide, a white salt, does not correspond with the "New Activity," which is not white, and which has not yet been found to be a salt; and lastly, scientific authorities who have been consulted regarding the "Dickinson Activity" have not altogether associated it with Thorium, since so many of its other properties are completely different to those of Thorium, so consequently the suggestion that the "Dickinson New Activity" be Thorium, etc., can also be laid aside.*

Polonium.—(Refer back: page 26.) Polonium, like Uranium and Thorium, was once, though ignorantly, suggested to be the substance known as the "Dickinson New Activity."

However, Polonium "emits" almost only "a" rays, whereas the "Dickinson Activity" possesses a "b" ray and a "g" ray. Polonium, again, has been found different in many respects, and Polonium is the least active in one sense of the "radio-active" group, whereas the "New Activity" has been found to be considerably "radio-active."

Polonium also does not possess either penetrating rays, emanations, or the power to render other bodies "radio-active."

Hence it follows that the "Dickinson New Activity" cannot be said to be Polonium, and so this theory also falls to the ground.

* Since the writing of this article a scientific expert, who was one of the pioneers among the workers on Thorium, has definitely told the writer after examination that Mrs. Dickinson's crystals are not any form of Thorium.

Actinium.—(Refer back : page 27.) Actinium has not been put forward as one of the possibilities to account for the “ Dickinson New Activity,” but as it is included in the table of “ radio-active ” elements (page 23), a few words about it will not be out of place.

The method of production of Actinium is not known, whereas Mrs. Dickinson knows how to “ produce ” or isolate her “ radio-active ” crystals. Again, Actinium emits “ b ” rays, which can be absorbed by lead, while the “ New Activity,” as well as possessing “ a ” rays—which Actinium does not—possesses a ray which is not absorbed by lead. Actinium also has a short life, whereas the discoverer has estimated her “ radio-activity ” to have a long life. Hence it is unnecessary to state that the “ Dickinson New Activity ” is not Actinium, since it in no way corresponds with it in properties.

Ionium.—(Refer back : page 28.) Ionium has also been dealt with in Chapter I. as being a “ radio-active ” body. Ionium gives no emanations, as the New Activity is believed to do.

Ionium only gives “ a ” rays of a low range, whereas the “ New Activity,” besides emitting “ a ” rays in many respects similar to those of Radium, possesses *other* penetrating rays.

Ionium is believed to be the parent of Radium, and to be changing rapidly into Radium, whereas, of course, the “ New Activity ” has not been found to do this. So the above-mentioned facts are sufficient to show the impossibility of the “ New Activity ” being any form of Ionium.

Potassium and Rubidium.—(Refer back : page 28.) Potassium and Rubidium, like Ionium, were mentioned in Chapter I. as being “ radio-active.”

The known “ chemical ” properties of these two elements would render them easily recognised at once, should the “ New Activity ” ever be suggested as being either.

Although Potassium and Rubidium give “ radio-active ” effects, they emit no “ a ” rays to give scintillations on zinc-sulphide. They give no “ emanations,” nor are they capable of imparting “ induced radio-activity ”

to other surrounding bodies; and since the "New Activity" does give "a" rays which scintillate upon zinc-sulphide, and it is claimed to give "emanations" as well as many other different properties, it will be seen that the "New Activity" cannot be said to be either of the elements Potassium or Rubidium.

The Dickinson "New Activity" and "Induced" Activity.—Perhaps of the Dickinson discovery, the fact that other substances can, as Mrs. Dickinson states, be so easily rendered "active" by it, is one of its greatest and most important features.

In this point of "induced activity" the "radio-active" material discovered by Mrs. Dickinson is said to far and away supersede the inorganic Radium. The small quantity of Radium in existence, together with its expense and its difficulty to manufacture and handle, render it a substance unsuitable for practical and commercial purposes.

Whereas the "Dickinson Activity" can be readily and beneficially applied to many ordinary everyday things, and the idea is that the discoverer, whilst possessing only a small quantity of her original discovery, will be able with it to treat in large quantities other substances for commercial use; and it is with or from these other substances that the majority of the work will be done—as has been the case in the past, take the "radio-active" water, for example.

And once these secondary substances have been made the agents or mediums possessing the "activity," they themselves will be capable of exerting an energy to a large degree, which could possibly be converted into work, and thus be distributed and utilised for industrial purposes.

The discoverer long ago realised the great possibilities that could be done with certain things, if they could be easily, cheaply, and quickly rendered "radio-active," and she thereupon set to work to devise methods by which her newly discovered "activity" could be imparted to ordinary articles in general.

This she has already accomplished by her own process, and which she assures us is comparatively simple. For example, ordinary substances, like oil, water, etc., have

been found among the commodities that lend themselves very readily for receiving this “ induced activity,” and they have also been found when rendered “ active ” to have been increased in vitality and virtue, and to have behaved more efficiently than when previously untreated. Thus we may be able, by “ treating ” articles such as these, to get out of them a greater proportion of energy and work than can be otherwise obtained.

It is important to note that though these substances have in a sense been made different in their “ working ” to what they were before, their ordinary properties often appear to remain unchanged chemically.

A few of the exact differences and the advantages which have been found to result from the “ treated ” materials will be dealt with in the next chapter, but it is sufficient to say that actual differences and increased efficiency have been detected, which can be accounted for only by the treatment of the “ Dickinson Radio-active ” process, which, as mentioned before, the discoverer tells us is simply and cheaply accomplished, and which she is prepared to carry out on a large scale.

No doubt this work also is still in its infancy, and nothing like the full possibilities, or even the best methods of performing it, or of the various purposes to which it could be applied, have yet been realised.

As we know, practically everything originally results from the “ energy of the Sun.” “ Radio-activity ” has once been likened to a form of “ concentrated Sun energy,” and so possibly the oils and water become indirectly treated by an “ activity,” akin to “ Sun energy ” under their treatment with the “ Dickinson New Activity,” at least this is a theory the discoverer holds.

One peculiar point, however, which has up to the present been observed, is that in cases where objects have been rendered “ radio-active ” by this “ New Activity ” no detrimental results have accrued from them, but on the contrary beneficial effects have been noticed.

So, to conclude, we arrive at a few vital points. Firstly, can this “ imparted radio-activity ” be stated as being temporarily or permanently retained? The discoverer claims it is permanent. It is early days, of course,

to be sure of this, but water rendered "radio-active" over two years ago is certainly to-day found to still possess this property, and to all appearance in the same degree.

Secondly, another point to consider is: Exactly what substances can be advantageously rendered "active" by the "New Activity"? Work must be carried out, and is being done, to determine this.

Yet a third point is found in the question as to whether the best methods of "inducing" this "New Activity" in other products has yet been arrived at? And perhaps the most important phase of all is whether there is a sufficient quantity of the "New Activity" to enable it to be continually used on a large scale? and whether the expense for the use of the same will make the proposition worth while? In this matter we must trust ourselves in the discoverer's hands, who confidently assures us, without any hesitation, that there will be no difficulty at all on these scores. And certainly, if Radium is practically indestructible, and the "New Activity" resembles it in this respect, then there is no reason to doubt this, while finally it is the intention of the discoverer to devise the necessary mechanical apparatus for its practical use, so that any one can "charge or treat" their own particular substances for use from time to time as they so desire.

It has been stated on pages 50, 52, that Mrs. Dickinson discovered her Radio-Activity in a mixture of certain oils, gums, and scents, many of which were also used by her in an "Antiseptic Perfume," etc.—the author thinks it worthy of interest to remark that the well-known perfume Musk, extracted from the glandular secretion of the musk-deer, has been found to behave like Radium in continually firing particles off from itself for an almost indefinite period.

Musk, too, like Radium, keeps for a vast number of years. Just as the minutest part of a grain (one three-thousand-millionth) of Radium can be recorded by an electroscope, so can so small a part as one three-millionth of a grain of Musk be detected by a keen nose.

What can it be that accounts for these unusual properties of the perfume, Musk? The author has found

so much of interest in his experiment upon Musk that he thinks it probable that some of the other perfumes may have curious properties not yet discovered.

And now let us turn to the next chapter where the valuable “ commercial uses ” of the “ Dickinson New Activity ” will be dealt with in their own rights.

REFERENCES AND BIBLIOGRAPHY, ETC., TO PART II., CHAPTER I.

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CHAPTER II

THE "NEW ACTIVITY"

The "New Activity"—its Wide Commercial Value.—

There are so many persons who only consider anything successful if it is a "commercial success," and can be utilised as a money-maker. It must be understood that Mrs. Dickinson, in placing her "New Activity" before the world, has been desirous before all else of establishing it as a "scientific" fact, and her newly discovered activity has already awakened a deep and lively interest in scientific circles. This interest has naturally also permeated into the unscientific, but financial and business world, where its merits are only viewed from its standpoint of making money, and the discoverer, having always borne this aspect in mind, has spent considerable time and energy during her research with a view to ascertaining in what directions her discovery could be successfully employed. And throughout this research many interesting facts have already been disclosed.

Naturally its commercial value has not yet had time to fully mature and to be appreciated as something of world-wide interest which may "come to stay." But from the experiments which have been carried out, it has been found that many marked improvements can be effected by the Dickinson "New Activity." Of course the field of possibilities into which this work could be carried is far too great to be even suggested, leave alone dealt with here; but we will mention a few of the *actual* results which have been obtained from the "New Activity" in the following pages. These results are more or less in the form of a collection of the test cases to which the "New Activity" has been subjected. At the end of the book can be seen some of the original

bona-fide reports, letters, testimonials, etc., from which references to the work in question have been taken.

Dealing with this part of the “ New Activity,” one of the first original uses to which it was applied was in the manufacturing of “ *Antiseptics*,” about which we deal in the following few lines.

Antiseptics.—It was while experimenting with oils, gums, etc., with a view to finding a perfect antiseptic, that this “ New Activity ” was firstly accidentally discovered. Oil used as an antiseptic is, of course, one of the oldest known things in the annals of history. Oil was used by the ancients on account of its preserving properties, as in the case of the embalming of the Egyptian mummies,* and even long before that oil had been held in the highest esteem by mankind. Oil was the agent used at anointings and great functions; oil, on account of its cool, soothing, and healing properties, was used in illness; and right up to the present day oil is used in the ritual of the Catholic Church in its anointings—*i.e.* Confirmation; and its therapeutic properties and soothing qualities are still recognised by its being resorted to at the bedside of the sick and dying in the Sacrament of Extreme Unction. So, when bearing all this in mind, it is not really so very extraordinary for the discoverer to have found so great a property as “ activity ” in so humble a substance as oil.

Thus it is that Mrs. Dickinson has turned out with the use of her “ radio-active ” oils and “ radio-active ” water, etc., a magnificent antiseptic. This antiseptic has never failed in its work. It has already been manufactured on a small scale, and is found to be very successful. This antiseptic has been supplied to some of our leading hospitals, and has incidentally been recommended by a certain Wimpole Street specialist as “ the finest antiseptic he had ever used.”

* It is of interest to note that the Egyptian mummies were preserved by “ cedar tree pitch,” which Pliny says was the “ liquid distillate of pitch-pine.” Pitch-pine, it will be remembered, was one of the constituents used in Mrs. Dickinson’s discovery—refer back: page 49.

Radium was extracted from “ Pitch-blende.”

It was no doubt its exceptional qualities which led to the discoverer being awarded, at the 17th International Congress of Medicine, 1913, the Silver Medal and Diploma for Fine Antiseptics, after their Jury had rigidly examined her "Antiseptic Perfume,"* and found it to be, as well as a most perfect antiseptic, a germicide.

This antiseptic was at first supplied to hospitals, to nursing homes, and to private people on a small scale—to-day it is sent to all parts of the world, and some of it, which naturally found its way into the trenches at the front, was spoken of so highly that "more was asked for."

The Dickinson Antiseptic, and a Case Cured by it.—A certain medical officer† in charge of the Ambulance Department of one of our leading railways has himself been completely cured of a long-standing trouble. In his certificate he says, "That for many years he had suffered from an 'Antrum Abscess,' for which he had undergone three surgical operations by specialists. Unfortunately he afterwards found that this operative treatment had failed to effect a cure . . ."

He then underwent, he states, with his doctor's approval, Mrs. Dickinson's "Radio-active" treatment, which included having a tube containing the "radio-active" crystals placed in the affected part, so that the abscess could be exposed to the "rays." The part was also continually treated with Mrs. Dickinson's oils, her *Antiseptics*, and subjected to the "rays" from Mrs. Dickinson's specially designed ray-box—an invention of her own for this purpose. In a few months this treatment completely cured him, he says, and made him better in health than he had been for three years. . . .

His report (see page 169) continues by expressing his willingness to undergo any severe medical examination—which has since been done, and it has been found that the cure is complete, there being no recurrence.

This gentleman, on account of this, now uses nothing else but Mrs. Dickinson's antiseptics throughout the treatment of the employees of the said railway, of which,

* Called "Dongor," as already stated, page 49.

† I.e. an officer of the said railway's staff, in charge of their own medical department.

"active," and raises it up; hence it is unnecessary to use yeast. This "active" bread, as well as possessing great preserving qualities and remaining fresh for a very long time, does not go sour, since it only has one or two ingredients.

Analysis shows that "yeast organisms" are not destroyed by the process of baking, and it has been asserted (though this may or may not be true) that these organisms set up a fermentation in the stomach, which, as the teetotalers claim, creates a craving for stimulants; and since alcohol is the natural antidote to fermentation, it becomes the cause of spirits being instinctively resorted to. Should this fact be true, it will be seen then that the "radio-active yeastless bread," unlike ordinary bread made with yeast, does not do this, as it consists of no artificial fermentation, and is free from alcohol, sugar, or deleterious saccharine matter, all of which are asserted to be the cause of harmful gout-giving acidity.

Irrespective of the saving of yeast—and not being dependent upon German yeast—and of the long life of the "radio-active" bread, it certainly is, from an edible point of view, a most perfect bread, and a food giving health and stamina; and no doubt, on account of these merits, it may become commercially a great national asset. Numerous reports and testimonials have been received from many quarters, and any one can try for themselves this beautifully delicious bread, which is being made to-day.

The actual method of making this yeastless bread is to add "radio-active" water to the flour in the correct proportion, and to leave it to mature for about eight days. The "activity" of the water apparently causes a natural ferment to take place, and this flour can then be added—*i.e.* as "a little to leaven the whole"—to fresh flour and water, and loaves of bread can thus be made.

Incidentally we may mention that ordinary "yeast" bread has also been made with the "New Activity." In this case *the yeast was rendered "radio-active,"* and the other ingredients of the bread also purified and treated by the "radio-active" process. This "radio-active" yeast bread is a very superior article, and though made

PLATE No. 14.



YEASTLESS BREAD.

NOTE. The above photograph shows two loaves of Mrs. Dickinson's "Yeastless" Bread. As has been stated (see Article), perfect Bread can be made from ordinary flour and Mrs. Dickinson's Radio-Active Water only, without any yeast, owing to the natural fermentation which Radio-Active Water sets up with ordinary flour.

The photograph clearly shows how well the "Yeastless" loaves have "risen."

(Ref. pages 103, 104.)

with inferior flour, has been found to be as nice and nutritious as any of the finest sorts. This bread also derives the preserving qualities characteristic of the "New Activity," and all bread made with the "New Activity" possesses a natural shiny glaze; and although the process of manufacture is slightly longer than that of ordinary bread, there does not appear to be any or much loss in weight throughout the baking of the "radio-active" bread.

The discoverer herself has not solely confined her "radio-activity" to bread-making,* but has also naturally (in a series of experiments) applied it to cakes, pastry, and other branches of cooking, and there is no reason to see why it should not prove to be a very valuable boon in this branch of culinary science.

Cement and Concrete.—No trade could possibly depend more on a certain particular article than builders do on their cement. Cement is a specially prepared adhesive substance, made from Calcium Aluminium Silicate and other things, manufactured largely in this country, Belgium, and also in Germany. It is a whitish-grey powder supplied in sacks for all building purposes, and can be stored in that condition indefinitely. When actually required it is mixed up with water, used, and allowed to set, its final setting being hard, permanent, and waterproof. In cases where "concrete" is required, only a certain proportion of cement is used, the remainder consisting of pebbles or stones; and, of course, where cement or concrete are either too expensive or not suitable, "mortar" is used.

And so with "Cement and Concrete" this discoverer has tried many experiments, using her "radio-active" water. Small samples of cement made with ordinary water have been prepared; and similar samples of the same cement, but made with "radio-active" water, have also been prepared, and both have been allowed to set.

* References to bread making with Mrs. Dickinson's "Radio-activity," see B. & H. Society, June 17, 1915; B. & H. Society, December 24, 1914; B. & H. Society, January 14, 1915; *The Daily Sketch*, February 15, 1915; *The Evening News*, January 27, 1915; *Answers*, March 13, 1915; etc.

Mrs. Dickinson has then made careful analysis and microscopic examinations of the results, and she assures us that the “cement” made by her “radio-active” water is very water-proof, stronger, and more durable than that cement prepared with ordinary water. The “radio-active” cement also acquires, she adds, a beautiful natural or “unartificial” gloss of its own.

Test experiments have been independently carried out at large cement works—*i.e.* The British Portland Cement Manufacturers, Upper Beeding, Sussex—upon some “briquettes” made with ordinary water, and upon some others made with Mrs. Dickinson’s “radio-active” water.

These briquettes were made in some cases of “neat cement” with $22\frac{1}{2}$ per cent. of water, and in other cases they were made of Sand and Cement (3 to 1) with 8 per cent. of water. Half of the “Neat” briquettes and half of the “Sand” briquettes were made with the Company’s water tap, the remaining halves were made with “radio-active” water—that is, their same water, but which had previously been charged by Mrs. Dickinson, who had placed a sealed tube containing her “radio-active” crystals in it for three-quarters of an hour.

Some of these otherwise identical briquettes were broken after seven days, and others after twenty-eight days, and tested for Tensile Strength upon the Le Chatellier Expansion, the result in “average strains” being that in three out of four comparative cases the “radio-actively treated” briquettes, especially in the sand cases, were found to be stronger than those made with the same water in the ordinary way. (See report of the works, August 7, 1918, page 172.)*

None of the briquettes were tested for differences in Compression; but this the writer believes always bears a definite proportional ratio to the Tensile Strength, and can therefore be accordingly estimated.

NOTE.—It is only fair to add that in a previous report from the same works, the radio-active results proved inferior to the ordinary results obtained. (F. A. H.)

Mrs. Dickinson hopes shortly to have "radio-active" cement made upon a large scale, and there is every reason to believe that it should turn out to be a great commercial success.

Modern cement and concrete, as we know, after a time decays, and does not possess very long-lasting qualities (*i.e.* like the cement, for instance, originally employed by the Romans, which is still firm and solid to-day), and possibly, since "radio-activity" appears to be of an indestructible and permanent nature, it may be able in a degree to impart this property to cement, and to render it of a more enduring and preserving nature.

The building of "concrete ships" is a new principle which is engaging the minds of shipbuilders, thus enabling large ships to be constructed rapidly for War emergencies.

Experiments in America upon "concrete ships" have proved highly successful, and Mrs. Dickinson has offered her "radio-active" concrete to the Admiralty to be tried for this purpose.

Cement is a branch of research in the "New Activity" which has yet to be more thoroughly studied.

Coal, Treatment of ; Coal Gas, Extraction of, etc.—Coal can also be mentioned as having been treated by Mrs. Dickinson with a view to increasing its "efficiency." The discoverer says that coal can be rendered "radio-active" from the "radio-active" water by a special process, after which the water is evaporated off, and the coal is then said to have been increased in virtue.

In one case an engineer, who had independently carried out an experiment, says he found that a quantity of "radio-actively" treated coal ran a railway engine for thirty-nine hours longer than the same coal usually did when untreated.

This "radio-actively" treated coal appears, according to Mrs. Dickinson, to give more heat and to form a more perfect combustion than ordinary coal does. She also adds that it burns slowly and leaves but a little waste ash.

Mrs. Dickinson states, too, that she has in a small way been able with her "New Activity" to extract pure gases from coal and oils.

This has been accomplished by a method of her own, and one which at the time of going to press Mrs. Dickinson is arranging to carry out as a commercial experiment in large gasworks, the results of which can, of course, only be known when these trials have been made.

Corrosion or Scale in Boilers, and its Prevention and Removal by the “New Activity.”—For years in the steam world engineers have been endeavouring to produce a “perfect” boiler, but up to the present one may say in general that no such thing yet exists.

One of the great difficulties to be overcome in obtaining a perfect boiler is that of doing away with the “Corrosion or Scale” set up in it by the water. This Corrosion is said to be caused by an Electric or Galvanic action.

We all know how an ordinary kettle in the home after months of continual use becomes encrusted thickly upon the inside from the deposits left behind by the water. In the case of the kettle this matter is not of great importance, as the encrustation can be easily removed and the kettle cleaned, whereas in the case of a large boiler, which is composed of several small pipes or tubes, this scale is a very serious item.

Since, firstly, it will be seen that it is no easy matter to clean the insides* of several long, small, narrow tubes.

And secondly, owing to the state of corrosion in these tubes, their internal dimensions will naturally have become diminished, which results in the “steam efficiency” in power of the boiler becoming lowered, and more coal needed to heat the water in the tubes, as scale is such a bad conductor.

While thirdly, in the case of engines, or where there is but one single boiler in a large factory which drives *all* the steam plant, it will be seen that not only after some time must the boiler be rigidly cleaned out (prior to which the “steam efficiency” has been gradually dropping off), but that during its being thoroughly cleaned expense and waste of time is incurred, to say nothing of perhaps the most important point of all, which is that

* Referring to a “water-tube” boiler.

the machinery in the whole factory dependent upon that boiler must remain idle while the corroded pipes are being chipped and scoured out.

Consequently to overcome these difficulties engineers and designers have to make certain allowances, one, of course, being to always have—where "steam" is depended upon—a clean "reserve" boiler, so that when the others are having their necessary clean out this "reserve" boiler can be put into operation for the time being.

Another precaution which engineers take when designing "new" boilers is to make provisions rendering them easily accessible for cleaning, and special rods, etc., for facilitating matters have to be supplied.

Besides these mechanical difficulties being allowed for, chemical considerations have also to be taken into account.

From the aspect of the water which causes the Corrosion many theories have been put forward explaining how to compensate it, and numerous attempts have been made to supply a "water which will not corrode." Acids, chemicals, and the like have all taken their share, but up to the present boilers still corrode.

In the cases where strong acids have been employed, it is admitted that the corroded scale has been diminished and even removed; but acid has a detrimental effect upon metal, hence in using it the inner surfaces of the pipes become deteriorated.

Another popular method in vogue at present is to try a small percentage of Arsenic in the water; but Arsenic is poisonous and dangerous to use, and this method has not been found altogether satisfactory. Then there have been the Electrolytic Processes, the Anti-Corrosive Tablets and Solutions, etc., all intended to prevent water forming scale.

Very soft water, or soapy water, for instance, does not cause such serious corrosion; but soft water is not suitable for continual use in steam engines. Then again, methods are often devised at the Waterworks supplying town "mains" to render the water "pure" (chiefly for drinking purposes, though, of course, this water gets used for machinery) so as to destroy some of the deposits in it.

In this respect small traces of chlorine have been fairly successful, although the public generally complain, saying they dislike the taste of "chlorinated water." Then Lime and various methods of filters, etc., are used for purifying water; sulphate of copper is also a cheap and simple method of water purification, one or about one-half per cent. being employed to a million parts of water. Yet again water has been exposed to the "Violet" rays, obtained by means of a special lamp; but this process has not been very successful, though it is claimed to render the water *absolutely sterile*, and to kill Bacteria (*B. Coli*) and the germs of Tuberculosis, etc.

So, to return to "corrosion," it was natural that the discoverer of this "New Activity," knowing that she could produce a "radio-active" water (by treating ordinary water with the "rays" from her crystals), turned her attention to ascertain what its effect would be with regard to the removal of corrosion from piping.

Experiments were firstly tried on a small scale in the laboratory, where it was found upon using two small identical pieces of badly encrusted boiler pipe (from a water tube boiler), and treating one with ordinary water and the other with "radio-active" water, that great differences were observed.

One piece of the pipe, containing the effect of some years' corrosion, was placed in ordinary water and boiled over a Bunsen Burner. After about half an hour's continual boiling it was removed from the water, when the pipe was found to contain exactly the same amount of corrosion as before.

The other piece of pipe, the same in every respect as the first piece, was placed in a similar quantity of water, which the discoverer had previously rendered "radio-active," and then boiled in exactly the same manner as the first piece. After about forty minutes this latter piece of pipe was lifted out, having *no* corrosion whatsoever in it, and appearing like a section of a new piece of clean tubing. The corrosive sediment which had come away was partly solid, and was partly dissolved in the water, which was, of course, discoloured, while the piping itself under this method of de-corrosion had not in the least

PLATE No. 15.

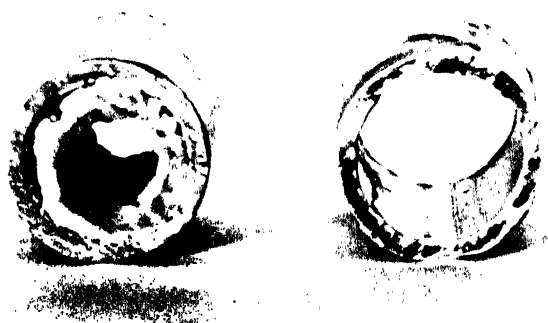


Photo by F. J. Tatner, Kemp Topp, Brighton, 1918.

CORRODED AND DE-CORRODED SECTIONS OF PIPING FROM A WATER TUBE BOILER.

The above photograph illustrates sections of metal piping from a water tube boiler. On the left, the section of piping shows the scale or corrosion in it, the result of many years' use. The second pipe on the right shows an identical section of metal piping, but with the corroded scale removed from it, by the action of "Radio-Active" water only.

This was removed in front of the writer, by its being boiled in "radio-active" water for about forty minutes—previous boiling in ordinary water had failed to produce any effect upon the hard scale. (See Article on Corrosion.)

(Ref. page 111, line 2.)

been damaged. The photograph of these two actual results is attached. (See Plate 15.)

This experiment then demonstrated that Water treated by the Dickinson "New Activity" could remove Scale from piping in this simple method; and so the discoverer, always remembering that "The Suggestions of to-day may be the Realities of to-morrow," naturally wished to have this experiment tried further in a practical way on a large scale with big machinery, since she realised that if it proved satisfactory its uses would be of the utmost importance in all branches of steam boilers, heating systems, etc.

And with this end in view, a Locomotive Inspector of one of our leading railways (*i.e.*, L. B. & S. C. R.) was asked to experiment with the Dickinson "Radio-Active" Water with regard to its effect upon Corrosion, and to make a report on the same. This he did, and his statement only corroborated what had been found in the laboratory.

In his report (see page 176) he says that he experimented with "Radio-Active" Water upon a cylindrical vessel (9 ins. diameter by $11\frac{1}{2}$ ins. long) which had become badly encrusted, in some places a quarter of an inch thick, by deposits from ordinary water which had been accumulating for over two years. These encrustations consisted of two separate strata, a light brown one and one resembling a filament of slate and of a more obstinate character, for which in the ordinary case hydrochloric acid would have been the only remedy for removal.

"Radio-Active" Water was next continually boiled in this vessel, and after a little time the encrustation commenced to gradually come away in the form of a sandy substance, and later as thin flakes, of a maximum thickness of $\frac{3}{128}$ in.; this course was continued until the vessel, by the action of the "Radio-Active" Water, had become *completely de-corroded*, and, to use his own words, he says, "No deleterious effect was observed on the walls of the vessel"—such as acids would have caused.

He noticed particularly that not only had the "Radio-Active" Water *removed the encrusted scale*, but that the water in itself had *left no further corrosion*.

And, in generally summing up, he considers that the process would be most satisfactory for Marine boilers, secondly for Station boilers furnished with condensers, thirdly for Station boilers not furnished with condensers, and fourthly for Locomotive Work. . . . And he points out that with the adoption of “ Radio-Active ” Water in *new* boilers “ corrosion ” would be practically prevented, while in *older ones the scale would be gradually eliminated*. He is also satisfied that, if the above process were adopted on a large scale, that its possibilities would be very great, and that beneficial results would accrue.

In another previous report (page 177) a Mechanical Engineer of the same railway states, that following his experiments with “ Radio-Active ” Water for the prevention of scale and corrosion of boilers, condensers, etc., he found the old scale previously deposited became *gradually* eliminated, finally producing a clean heating surface, and at the same time he found that the use of “ Radio-Active ” Water rendered the boiler *immune from the formation of further corrosion*. He also lays stress on the “ efficiency ” of the action of the “ Radio-Active ” Water, pointing out that a more economical process could not be imagined, as no apparatus or labour is required in its application.

Following these three results, other experiments have from time to time been carried out upon “ corroded pipes ” with the Dickinson “ Radio-Active ” Water. In one case experiments were conducted by the engineer of a London hotel, with a view to it being adopted in their hot-water heating system.

Another important practical *test* case, which is here given, was independently carried out by a well-known firm of pumping, filtering, and refrigerating engineers (*i.e.* The Pulsometer Engineering Co., Reading, Berks.), for whom Mrs. Dickinson, by means of her “ radio-active ” crystals, had charged the water in the feed tank supplying their boiler, on which they were to make the trial.

Quoting extracts from their report, issued at the conclusion of the trial, they say, “ When the boiler was opened out we found that not only were there no signs whatever of any fresh scale having formed, but that the

old scale had come away from the boiler surfaces and was found in pieces in the headers and in the mud drum at the bottom of the boiler. In the mud drum we found in addition soft mud, which, under ordinary conditions, would have been blown through the blow-off cock, as it was quite soft and showed no signs of caking.

"In this soft mud we also found sections of the old scale, some sections showing clearly the contour of the tubes, and others the contour of the headers.

"The internal surfaces of the boiler and steam drum were quite clean, except that they were covered by a thin layer of fine yellow dust, which was easily wiped.

"This shows that the Radio-active matter apparently alters the physical condition of the water in such a manner that the solids left after the water evaporates are in the form of fine powder, instead of the usual form of a hard scale adhering to the boiler surfaces.

"The treatment does not cause any alteration in the chemical composition of the water, because, when tested by the usual hardness tests before and after treatment, the same hardness is registered.

"Instead of having to chip the scale out of the boiler, which is a long and expensive business, we are now merely brushing and washing out the deposit, and the boiler will be closed up and put to work again."

The full technical report referring to this trial is attached. (See page 178.)

Hence, judging from all the past-mentioned experiments, one cannot speak too highly of the action of Mrs. Dickinson's "Radio-Active" Water for use in all pipes, etc., where corrosion has otherwise proved detrimental.

The writer himself witnessed the laboratory experiments referred to, and also the last trial just given, and can certainly vouch for the wonderful power possessed by the "Radio-Active" Water in this respect, and he feels sure that these results suggest a tremendous commercial future for the use of Mrs. Dickinson's "Radio-Active" Water in boilers, etc., or where scale, due to ordinary "untreated" water, has hitherto been one of

the greatest bugbears and disadvantages worrying steam engineers.*

Extraction of Colours from Flowers.—Many of the colours used in painting are either metal or chemical preparations. Now Mrs. Dickinson says that by the action of her “radio-active” water and “radio-active” oils, etc., she has been able to abstract the “natural” colours direct from various flowers under a process of her own, which is so simple a one that it need not be dealt with here.

Ordinary paint too can be greatly improved by the “radio-active” oil, which is said to impart to it a shiny glaze and better preserving qualities.

Fats.—The purification of fats is yet another way in which the “cleansing properties” of Mrs. Dickinson’s “radio-active” water have been made use of. Certain dirty fats, suet, etc., which would otherwise have been thrown away by large firms, have been collected and sent to this discoverer for *experimental* purposes. They have been melted together and boiled with the “radio-active” water, which apparently has the action of cleaning them. The water is next carefully removed, when several pounds of pure white clean fat then remain.

This fat, which has seemingly been restored to its natural clean colour, conditions, and virtue, has been returned to the makers for further use, much to their satisfaction.

In the strict economy, which is always urgent in the use of all fats, this simple method of improving dirty or crude fats ought to prove of vital importance and value.

Fruit, Crystallisation of.—Under the heading of “vegetables” later, it will be seen that vegetables have been dried and preserved, or kept for use at some indefinite period, by the action of the “New Activity.”

* Refs.: Reports given, the writer’s own experiments, Mrs. Dickinson’s Lecture on “Corrosion and its Prevention,” etc.

NOTE.—It is of great “scientific” interest to remark that it has been recently discovered that hard water can sometimes be softened by being made to flow over an aluminium trough. The reason to account for this is not yet known. Some test cases were completely successful, others were complete failures.

Mrs. Dickinson has applied just these same methods for the crystallisation (in the preserving sense) of fruits. The fruits have been first dried and subjected to the "radio-active" water, to which sugar is added when necessary.

These crystallised fruits, like the vegetables, have turned out very successful; and the same London firm which is considering the problem of the "radio-actively" treated vegetables is also considering taking up the crystallised fruits, also made with the "New Activity" (*i.e.* preserved by the action of the "radio-active" water).

These preserved fruits certainly should prove of great value, if the results are anything like those which the writer has seen.

And since they can be indefinitely preserved by the "radio-active" *water only*, it should in no way impair their food value, as ordinary chemicals and preserves must to a certain extent do.

Germination of Plant Life.—Radium, though found to have a destructive action upon the vitality of seeds, was at one time tried in Agriculture, with a view to utilising its "activity" in the stimulation of plant life (refer back: page 40). Of the results, whether successful or otherwise, little has been written. However, an extract from the *Times* of September 25, 1915, states:—

"If Mr. Sutton's investigations can be accepted as conclusive—and they are so regarded by competent botanists and chemists—the farmer and gardener need look for no material benefit from Radium," etc.

Now the stimulation of plant life by the "New Activity" was a matter upon which Mrs. Dickinson was engaged during the early days of her discovery.

The first experiments were carried out upon flowers and plants; sometimes the loam or earth in which the plants grew received the "radio-active" treatment, and sometimes the water given to the plants was rendered "radio-active," and sometimes both the soil and the water were made "radio-active." The result of either treatment, however, showed that a "stimulating effect" could be produced.

Whereupon Mrs. Dickinson obtained an allotment solely for the purpose of demonstrating this fact in an

everyday practical way. The plot referred to was one among many upon an open down, and was planted with “ Savoy ” Cabbages, which were watched and watered with ordinary water which had been previously rendered “ radio-active.”

The results obtained by the “ radio-active ” water showed that all the cabbages thus treated were very healthy and had grown quickly ; they were so large and heavy when fully grown that every one remarked upon their size, which was greater than that of the other cabbages (though possibly not of the same species) growing upon adjoining ground.

A famous botanist and geologist (*i.e.* Mr. F. W. Keeble), on next hearing about the stimulating effect which the “ radio-active ” water could produce, and who presumably saw the cabbages, was deeply interested, and desired to conduct experiments for himself. Mrs. Dickinson therefore sent him some loam, some of which had been treated by the “ New Activity ” process and some which had not, for his own use. Quoting from his letter written later, he wrote : “ The cake of loam [meaning the “ radio-actively ” treated] you sent me I have experimented with with very good results ; especially in the case of groups of sweet peas the growth has surpassed the other most notably. . . . ” (Ref. : Q, or letter from F. W. Keeble, Tatsfield, April 23, 1916. See page 180.)

Later, following this, the writer himself next carried out a test experiment in the laboratory, this time upon some 1916 “ Oregon ” Barley. Two “ Coldewe’s Patent Germinators,” as used for barley testing, were procured. From a single standard sample of the above-mentioned Barley 200 grains were carefully selected ; 100 of these grains were placed in each receptacle, and both germinators were subjected to identical conditions (*i.e.* containing equal amounts of silver-sand, water, and subjected to the same light, temperature, etc.), both tests being commenced at the same moment.

One quantity of the grains was treated throughout with ordinary water, and the other was treated throughout with the same water, but which Mrs. Dickinson had rendered “ radio-active.”

At the end of a week the writer observed that the percentage of grains growing in the "treated" germinator was considerably higher than that growing in the "un-treated" one. The grains, which had grown slightly, were found to be far more advanced in growth in the "treated" germinator than those in the "un-treated" one, and as time continued to elapse the "treated" germinator was found to contain growing barley of a healthier, greener, stronger, and more advanced stage than that growing in the "un-treated" germinator, although both had been under similar *test* conditions, and had been commenced at the same time.

This experiment was witnessed throughout by many persons, who can all certify to the distinct difference arising from the action of the "radio-active" water. (See report, page 180.)

Another experiment to confirm the writer's was next independently carried out by a gentleman at his own home. His experiment was again a comparative one, but was tried upon Carnations and Roses. Firstly, extracting from his report later, he says (referring to the carnation grown by him with the "radio-active" water): "I see the carnation is ten days in advance of the one watered in the usual way, and also that the stem is 6 inches longer than the other. . . ."

These carnations incidentally had been grown from *two equal sized cuttings*, and had been subjected to identical treatment throughout the whole experiment during the summer, with the exception that one had been watered with "radio-active" water, while the other had been watered with ordinary.

Secondly, with regard to the two roses grown by him, these roses had been planted in Mrs. Dickinson's "radio-actively" prepared fertiliser; *both* the roses turned out to be exceptionally beautiful blooms, and quoting a second extract from his letter, he says: "I consider the first rose, 'Bessie Brown,' grown by me, also with the 'Dickinson' Fertiliser, was a *record one for size*. . . ." He also concludes his report by remarking: "I think from this little experiment that there is no doubt that the 'radio-active' water promotes the growth of the plants, and

also advances their flowering. . . .” (See report, page 181.)

So from these four experiments, namely, those of the discoverer, both at home and at the allotment, that of the botanist, that of the writer, and of the latter just mentioned, as well as others, it will be seen that the “ New Activity,” contrary to the action of Radium, possesses an “ active stimulating effect ” upon plants; and it can be readily gathered that its “ activity ” does *not* destroy the life of the seeds, but in fact actually assists in their promotion.

These experiments have not yet been carried out into practice on a large scale, though at the moment of going to press one of the greatest Seed Establishments in the world is conducting a series of exhaustive experiments upon the “ germination of plant life ” with Mrs. Dickinson’s “ New Activity,” which, if they consider successful, they hope to utilise.

At the present time, more than ever, when the world’s shortage of crops is so vital a point as to have been considered the “ crux of the situation,” surely if any enhanced value in vegetable or corn growing, etc., can be found in the “ New Activity,” then every measure ought to be taken to obtain its use.

In which case, instead of treating and watering one small allotment, arrangements could be made for cultivating whole estates with “ radio-active ” water, which could be supplied from large reservoir mains, which Mrs. Dickinson would be prepared to charge by her “ Radio-Active ” crystals from time to time as so required.

Yet again, it might be found possible to improve the “ seeds ” themselves by the “ New Activity ”; but this is too speculative at present to deal with.

Hair and the New Activity.—The effect of Radium upon “ Hair ” has been tried, and in the case of a rabbit skin treated by Radium the growth of the hair was found to be increased.

Now Mrs. Dickinson claims that the “ New Activity ” also has a similar effect upon the “ growth of hair.” Rabbit skins or the like, however, have not been experimented upon, but a middle-aged man allowed himself

to be the patient, and experimented with the "New Activity" treatment upon his *own* hair, to which he applied a special preparation of "radio-active" oils and "radio-active" water, etc.

According to this gentleman, the growth of his hair and beard became in time increased, and, as well as there being more of it, he says it became stronger and resumed more or less the natural colour it had been in the past.

This experiment, though of certain minor importance, is *only* referred to here by way of demonstrating one of the properties apparently similar to both Radium and the "New Activity."

Under the heading of "hair," it may also be mentioned that Horse-hair has been cleaned by the "New Activity." Some dirty horse-hair was sent from a hair-cleaning factory to be cleansed by Mrs. Dickinson's "Radio-Active" process. This hair was thoroughly cleaned merely by the action of Soap and "Radio-Active" Water, very simply, and in a very short time.

The finished hair, which was beautifully clean, still seemed to retain its natural "springiness" and oiliness (a point also seen in the case of wool, see page 138); and in all probability the "New Activity" (on account of both its antiseptic and asserted high preserving qualities) had to a certain extent rendered the hair germ-free, and had also increased its otherwise natural life.

Oil.—Oil has perhaps played the leading part in the "New Activity."

In oil was found the original medium from which the "New Activity" was obtained. Consequently much experimental work, both in the laboratory and on a large scale, has been carried out upon Oil.

It was found that oil, when treated by the "New Activity" under different processes, assumed certain qualities. For instance, the oil always remains bright and clear; at high temperatures it does not seem to thin and lose its body, while at very low temperatures it does not appear to thicken or coagulate, nor does it then precipitate out impure matter.

To verify the properties of "radio-actively" treated oil, exhaustive experiments were carried out on a big scale

by the engineers of a large railway (*i.e.* the L. B. & S. C. R.), and one of the Inspectors of the Locomotive Department of the said railway in his report says :—

“That while the ‘ specially treated oil ’ was being used on a railway engine, he took careful notes of its effect upon the W. H. Donkey Steam Cylinder (the air pump), the piston rods, and metallic packing, also the big-ends and driving crank-pins, and found it to be most satisfactory, particularly on the heated surfaces; and judging from the action upon highly heated piston rods, he considered it a good serviceable oil, which he would imagine to be effectual in cases of troublesome bearings.” He also continues to say in his report, that upon going back to the oil in general use the metallic packing of the engine was not nearly in such good condition, and that the glands were very troublesome. And lastly, he states that the experimental oil showed no sign of “ corrosion,” and that he would like to see it tried as a “ lubricant ” for valves and pistons. (See his technical report on page 182.)

On another occasion the same engineer experimented with Mrs. Dickinson’s “ radio-active oil ” upon *five different railway engines*. In this case it was used for the W. H. Donkey Steam Cylinder, slide bars, and piston rods on all five engines, as well as upon the six big bearings on two of the engines. The action of oil on the heated piston rods and in the steam cylinder of the Donkey are both, in his opinion, the best practical tests that an engine oil can be put to. He found, he says, that the “ treated oil ” was lighter, seeming to have lost its original stickiness (a point which in the usual course causes “ corrosion ” in a little time, retards the syphoning, making the oil unreliable).

He remarks also that the Donkey in every case worked equally as well with it as it does with more expensive cylinder oil, and that the drivers themselves were one and all of the same opinion. (See report, page 182.)

While another “ Inspecting Engineer ” in his report, referring to an experiment where Engine Oil “ B ” treated by the “ New Activity ” had been used on an engine, says : “ That as a ‘ lubricant ’ the oil in question was *especially successful* for the piston glands, which, being on the outside

are exposed to the atmosphere, and on the inside are in contact with 'steam' ranging at a temperature from 500° F. to 650° F." He reminds us also that the ordinary oil "B" (non-treated) usually leaves deposits of a carbonic character upon the piston rods in the form of small black specks, which, he says, were most conspicuously absent on the occasions when the "treated oil" was used, the rods appearing as bright silver. The glands also behaved excellently under the "treated oil," not giving the slightest trouble through blowing or other causes. And lastly, he says, that the engine men themselves spoke most highly of the "treated oil," considering it to be a great improvement to any they had previously used, not only for the above-mentioned parts, but also for the other bearing surfaces upon which they had used the oils. (See his testimonial, page 183.)

Thus it will be seen from the two last reports, which are only an example of many others, that Oil after being treated by Mrs. Dickinson's "radio-activity" is highly successful for *lubrication purposes*.

Its use has not solely been limited to "Steam" engines, but it has also been found highly suitable for use in "internal combustion" engines, and for many other general purposes. The fact that at high temperatures it does not seem to become thin and to lose its body, but that it maintains its high efficiency, is naturally a point of considerable importance where *lubrication* is concerned.

"Burning" oils for ordinary lamps, etc., have also been treated by the "New Activity." This same oil after treatment seems to be of a purer nature, and the discoverer says that it burns with a brighter and more luminous flame than it did before.

Paraffin, petroleum, etc., have also been subjected to the treatment of the Dickinson "Radio-Activity," and experiments to note the results have been carried out on a small scale. Unfortunately there has not been much opportunity for ascertaining its value in this direction; but at the present time, while petrol and other fuels are so scarce, many devices, as we know, have been resorted to, with a view to finding a successful propellant for the

motor car, among the latter, Paraffin, by special arrangements, has been tried instead of Petrol.

Now, owing to the very inferior quality of paraffin supplied to a certain motor owner, who had been practically unable to use his motor on account of its perpetually misfiring and faulty running, he was asked by Mrs. Dickinson, for the sake of an experiment, to treat his paraffin by her “radio-active” process. This he kindly consented to do. The paraffin was treated by her, and the tank was again filled up and the motor used. This time the owner assures us, so Mrs. Dickinson says, that he observed a marked difference, in that the motor ran perfectly and more satisfactorily in every way.

This highly interesting experiment, if it can be repeated, should be of great value from a practical and commercial point of view.

Another branch of Mrs. Dickinson’s experimental work upon “Oil” was that carried out upon “castor-oil.” The discoverer in these experiments had been endeavouring to improve upon the castor-oil that is used for aeroplane engines, aircraft work, etc.

Some of this particular oil was obtained and treated by the “New Activity.” A chemical analysis being made of the castor-oil before treatment, and of the same oil after treatment, showed that a slight *chemical* difference had been brought about by the action of the “radio-active treatment.” (See chart, page 184.)

In the case of castor-oil for aeroplane work, Mrs. Dickinson has had only one chief aim, and has treated it solely with that end in view.

She had found that her “activity” evolved heat, and in the case of water “radio-actively” treated its freezing point had become lowered; and so, in the hope of lowering the freezing or thickening point of castor-oil, Mrs. Dickinson has treated it accordingly.

Castor-oil, which, as we know, only thickens considerably at a very low temperature (something like -21° C.), has invariably been found to begin to “thicken” in aeroplane engines, owing to the extreme cold due to the height at which the aeroplane often flies.

A sample of this aeroplane lubrication oil was treated

for the Royal Aircraft Factory, South Farnborough, and was supplied to them. They submitted it to their own freezing tests, and found that the oil lasted for five days before thickening, whereas three days was the usual time for the same oil (*i.e.* their own un-treated) to last under the same conditions. The author can certify to this, as he was at South Farnborough himself at the time of the trial (January and February, 1918).

Further experiments have also been carried out upon a small scale, with a view to demonstrating whether Mrs. Dickinson's "radio-activity" makes any marked difference in castor-oil, or not.

In one experiment two identical samples of oil, one treated and one un-treated, were submitted to a temperature of 16° F. for 24 hours in a freezing plant. Of course at only this temperature neither oils would thicken much, though afterwards the un-treated oil was found to be very cloudy and to have precipitated a large quantity of solid impure foreign matter, whereas the "treated" oil was found to be perfectly bright and clear throughout.

Although from this experiment we are unable to say whether the "treated oil" had had its *freezing point lowered*, we certainly are able to see that Mrs. Dickinson's "New Activity" had undoubtedly exhibited the great purifying qualities it possesses, which have been referred to before as one of the characteristics of this "New Activity." (For this experiment, see report, page 184.)

Another experiment was conducted to demonstrate the fact (as stated) that the "New Activity" keeps oil from thickening or congealing at low temperatures. In the report of this experiment (*i.e.* see page 185) we see that four samples of oil under *identical conditions* were submitted to a temperature of 11° F. for 75 hours in a brine tank at a Refrigerating and Cold Storage Works, with the result afterwards that :—

1. A sample of Standard Pharmaceutical refined Castor-Oil, un-treated, was found to be clear, but of a considerably thicker consistency.

2. Another sample containing "crude" castor-oil, treated by the Dickinson "Radio-active" process, was found also to be clear, but had thickened a little, though

less than the first mentioned. It is important to note here that the Dickinson “Radio-active” process rendered “*crude*” castor-oil as clear as and less thick than “*refined*” castor-oil.

3. Another or third sample contained un-treated pharmaceutical castor-oil from the Royal Aircraft Factory, South Farnborough. This sample was found to be clear, but even it had thickened slightly.

4. The fourth sample, containing *pharmaceutical refined castor-oil, but treated by the Dickinson “Radio-active” process*, was found to be the clearest and best of all the oils, having no semblance of thickening in the slightest.

The last experiment again supports the claims put forward for the beneficial effect upon “Oil” derived from the treatment of the Dickinson “New Activity”; and, as the treated oils were the clearest and thinnest at low temperatures, as well as having been rendered non-corrosive (see engineer’s report, page 120), they should prove highly valuable for aeronautical purposes.

In reviewing the general work which has been effected upon “Oil,” it may be said that the action of Mrs. Dickinson’s “radio-activity” upon oil seems to be exceedingly great, and this certainly ought to be utilised from a commercial point of view; and, quite irrespective of the lubrication and burning qualities of the oils, etc., enhanced by the “radio-active” treatment, the other oils as used for the Antiseptics and other medical purposes (mentioned elsewhere) have also been found to be specially efficient.

But work has yet to be done to further all these branches of the effect of the Dickinson “New Activity” upon Oil.

Ore, the Softening and Disintegration of, etc.—Mrs. Dickinson has, among other things, applied her “radio-activity” to refractory ores, since she had found that it had the effect of rendering them more “friable.”

The exact ultimate results which are to be obtained from a metallurgical point of view have not yet been determined.

In an early experiment the “radio-active” oil and “radio-active” process was tried upon some hard Welsh

Arsenical Gold Ore, and it was found to have produced such remarkable differences in it, in that the *hard* refractory ore could afterwards be *easily broken up*, and the Gold successfully separated from the Arsenic in it in only a few hours. To accomplish this by other means is ordinarily a point of great difficulty. (Ref.: see the report from the Panorama Mine, Barmouth, November 4, 1914, page 188.)

On account of this fact, together with her other experimental observations, Mrs. Dickinson is consequently fully of the opinion that this "New Activity" could be greatly used in the treatment of various ores, and is as it happens at the very moment engaged upon this matter.

Certain interesting *test* experiments have latterly been independently carried out upon "Ore." One of these experiments, which much impressed the writer, is here given:—

In this case a quantity of *very hard* "Spanish" Ore (Cu/Ni/Co Ore, and rich in many other valuable minerals) was simply boiled for about two hours in Mrs. Dickinson's "radio-active" water. After being boiled it was removed from the water, when whole pieces of previously very hard ore were *within two minutes rendered a fine powder*, entirely by the action of being crushed *by hand* in a pestle and mortar.

Two ore experts, who have separately seen this and similar demonstrations, when questioned, have assured the writer that no other known chemical or mechanical processes could do this as efficiently, quickly, or as easily as the "radio-active" method had done.

In fact, one of these authorities referred to told the author that if this particular ore was boiled for a fortnight in the proper furnaces at the mines, and then submitted to *great pressure* from the usual mechanical crushers, that even then such a good result could not be obtained.

So it appears that the "radio-active" water must have some atomic action, the result of which apparently accounts for the splitting up or disintegration of the ore.

Mrs. Dickinson hopes to go still a step further beyond only the "disintegration" of the ore, as she believes that

her “radio-activity” could be made to separate out the individual valuable metals which are in the ore, and which up to the present in some cases it has not been found possible to do; with the result that tremendously valuable ore cannot be utilised, owing to this difficulty of extracting the metals, which means much ore being unworked and thus wasted.

One of these ore experts already mentioned, who had had some “radio-active” water sent down to him to experiment with, wrote from the mine later, after having conducted his experiments, and quoting from his letter he says, among other things:—

“With the ore (Spanish) there is no doubt that a very strong action of disintegration takes place, but as yet I have not been able to state whether the changes are merely of physical or chemical nature. . . . Certain it is that the water has a most unexpected effect,” etc. (See page 189.)

The above statement, like the previous experiments, clearly shows the decided action that this “radio-active” water must have upon “ore” to have produced such remarkable results.*

At the time of going to Press Mrs. Dickinson is still engaged upon this study, the full details of which we can only hope to give when further experiments have continued to prove this wonderful branch in her many researches.

Paper-Cleaning.—Irrespective of new Paper “Making” from rags or wood pulp, etc., clean paper is often re-made from already used paper, and in consequence of this Paper “Cleaning” has become an industry in itself. Old and dirty newspapers and other papers are therefore collected for the purpose of their being used again, and are then submitted (for this purpose) to a special process in Paper Mills.

The paper is firstly de-fibred into smallish threads by a series of crushing mechanical knives. This operation takes place in what is called a “Beater,” which is filled with water, usually hot; the paper is next placed in the

* Ref.: Brighton and Hove Society, July 30, 1914, letters, reports, etc.

"beater," and a solution of caustic-soda or some similar cleansing agent is added. The paper in this solution in time becomes completely de-fibred and de-inked, and assumes a soft greyish-white pulp, which is then washed, rolled out, and dried, or in some cases further bleached and mixed in with a certain percentage of size, gum, etc., and added to new pulp and made up into paper.

The whole process of paper "cleaning" takes some hours to effect, as ordinary printer's ink, which is composed of practically carbon and lamp black, is extremely difficult, owing to its insolubility, to remove from paper. Hence it will be observed that to de-fibre, de-ink, and pulp paper it requires, besides the plant and labour, heat and chemicals.

Now Mrs. Dickinson's "radio-active" water has been found to de-ink and pulp old newspapers, coloured papers, or even "mixed waste," *without* the addition of any chemicals or heat; and on account of this the cellulose is not so destroyed, and the surface of the paper is in a better condition than when strong bleaching chlorides have to be used.

The writer has seen the front page of a newspaper (*i.e.* the *Daily Telegraph*) de-inked and pulped, washed, rolled out, and dried, and made to become a white and clean sheet in twelve minutes by the process of "*radio-active*" water *only*, in a simple apparatus of Mrs. Dickinson's, and without any elaborate machinery being employed.

From this and other small tests it has led to large quantities (such as 6 tons) being cleaned in paper mills by Mrs. Dickinson's "radio-active" water only. This has been accomplished by firstly charging the cold water in the "Beater" (before the paper was added), by placing in it some sealed tubes containing the "radio-active" crystals for about 45 minutes, or until the water had become fully charged, according to the size of the beater.

The chemist and experts at the paper mills stated, after one of these trials, that the paper which has been treated by the cold "radio-active" water was actually better than the paper in a corresponding "beater," in which caustic-soda and hot water had been used. (Ref.: at the *Daily Telegraph* Factory, Dartford, March 13, 1918.)

We show a photograph of a piece of the *Daily Telegraph* before and after being cleaned by the Dickinson "radio-active" water only.

Paper "cleaning" by the Dickinson "radio-active" water is so simple, and has been so successful, that to prophesy its value or its commercial future would be a difficult matter; but paper cleaning by this simple method should be a great incentive to business men.

If the results obtained on a *very* large scale are anything like those which the author has witnessed in both the laboratory experiments and at the paper mills, surely then caustic-soda will become an unknown thing in paper cleaning.

And lastly, as to the best method of applying this "radio-active" treatment of Mrs. Dickinson's, the writer can see no better or easier way than to simply keep the main water-tank, which supplies the mills, always charged by the "radio-activity."

(A report on the Paper Cleaning Process is on page 186.)

Salt and the "New Activity."—The New Activity, on account of its "cleansing properties," has been experimented with and used for the purpose of purifying salt. Mrs. Dickinson assures us that the New Activity possesses a very marked effect upon salt. Small samples of *dirty* salt, by the action of the "radio-active" water, have, according to Mrs. Dickinson, been rendered *perfectly white and clean*; and Mrs. Dickinson also maintains that the salt has in no way been impaired by the action of the "Radio-Active" water upon it, but that on the contrary it has been improved and rendered more preservative than it was before.

Soap Making.—One of the few things common to every home is "Soap."

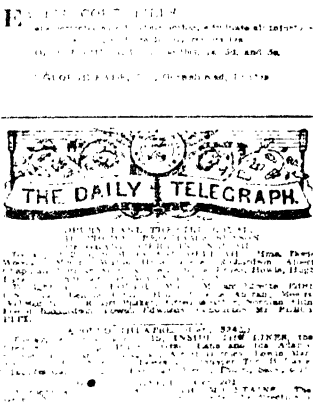
The use of Soap is very ancient. Pliny tells us that it was of Gallic origin. To-day Soap is made in different countries by varying processes, but the general compounds used in its manufacture are the same. Possibly caustic-soda and olive oil form the most common bases.

In the making of soap the great point always aimed at is "Purity." One well-known firm has for years past supplied a practically pure soap to the whole world; but

PLATE No. 16.

THE DE-INKING AND PULPING OF NEWSPAPER, BY THE DICKINSON "Radio-Active" WATER ONLY.

SATURDAY 2 15
 3: T 8.15.
 LAC DOMINO."
 FRANK TATOR.
 2.30 4 8
 CUMBER
 MANN



...the writer...
 ...the statement...
 ...the output...
 ...the question...
 ...the case...
 ...the paper...

FIG. 1.

Photos by F. J. Tanner, St. James's Street, Kemp Town, Brighton, 1918.



FIG. 2.

FIG. 3.

NOTE: Fig. 1 shows an ordinary portion of Printed Newspaper (in fact an actual piece of *The Daily Telegraph*, March 13th, 1918).

Fig. 2 shows what ordinary Newspaper looks like when "Pulped." As has been explained (see Article), Ordinary Newspaper upon being placed in Mrs. Dickinson's Radio-Active Water, in a simple Beater, can be rendered into this DE-INKED and Pulped state in about 10 minutes only; and without the use of any heat, chemicals, or bleaching agents of any kind. The writer has seen this same result obtained under *test* conditions on a large scale in the Beaters, at Paper Mills, though of course a longer time was required.

Fig. 3 shows the Pulp (in Fig. 2) when rolled flat, and dried. The beautiful white colour, the complete absence of any ink or lettering, and the undamaged texture, of the "Radio-Actively" Washed Paper, can all be well observed.

(Ref. page 128, line 1.)

excellent though it be, its price does not place it within the reach of all.

Now the "New Activity" was found by Mrs. Dickinson to be such a success in the manufacture of Antiseptics, disinfectants, etc., that many of the same compounds and methods used in the making of these have been utilised by her for soap making. Mrs. Dickinson, using her excellent "Radio-Active" oils, "radio-active" water, and specially purified fats, etc. (by the same treatment), long ago commenced preparing soap upon scientific lines for the use of the general public.

Not only are these soaps claimed to be *absolutely pure*, but they contain as well a small percentage of this discoverer's specially prepared "Antiseptic," which is said to render the already pure soap a *germicide*, and to in a degree impart to it certain healing qualities. Consequently with "this soap," as a journalist once remarked, "things are not only cleaned but are disinfected as well."*

It is unnecessary to add that, like the Antiseptics, Soap made with Mrs. Dickinson's "radio-activity" has been a great success, probably due to its containing some of her Antiseptics, which, as we will remember, were awarded the Silver Medal and Diploma on account of their merits, and which have won as well the praise and recommendation of some of the world's most eminent medical men.

The price of the soaps "radio-actively" treated has been necessarily not cheap, on account of only the finest constituents being used in their preparation. A few years ago, from a commercial point of view, the manufacture of these soaps (particularly the cream soap) had already attained a good position, and showed prospects of gaining a great future. Latterly, however, owing to the general shortage of chemicals, labour, etc., Mrs. Dickinson has been unable to have her soaps manufactured as widely as before. But she hopes with the adoption of special apparatus to be able to render "radio-active" the necessary oils, water, fats, etc., on a large scale in any Soap Works; and they will thus be able to still supply

* Ref.: Mr. Cayley Calvert, in Brighton and Hove Society, May 21, 1914.

away by him and handed to his son for experimental purposes.

He tells us that this spawn was divided into two equal proportions, one half being placed in a glass jar in ordinary water, while the other half was placed in another glass jar of equal size, but in “radio-active” water, supplied by Mrs. Dickinson. The two jars were then kept in identical conditions as to light, warmth, etc.

In this case, as before, in a few days the eggs in the “radio-active” water reached the stage of maturity first, and several of them hatched out into tadpoles—which at the time it was considered to be ahead of any of the others; however, in the end, *none* of the spawn left in the ordinary water ever hatched out at all, while the tadpoles were fed and lived for quite a long time in the “radio-active” water. (Ref.: experiment carried out by W. Baggally, junior, and witnessed by W. W. Baggally, Spring, 1918.)

The writer is fully acquainted with this case, and both Mr. Baggally and his son, who conducted the experiment, have certified to finding this marked difference, as given by the writer. In the case of Mrs. Dickinson’s experiment, the writer who watched the case throughout can equally certify to the accuracy of the extraordinary result observed, though he cannot account for its cause.

From these experiments, though small in their way, there appear to be several indications which tend to the belief that the Dickinson “radio-active” water possesses a strong stimulating effect upon the life of animals in the same way that it has been found to have a stimulating effect upon the germination and growth of plants (as already referred to).

From these facts we gather that water after being treated by the Dickinson “radio-activity” must become different to ordinary water; and it can also be seen that it acts in a contrary way to the natural inorganic “radio-active” waters, which, as far as the writer is aware, have never been known to show any stimulating effects, either upon animals or plants.

Of the actual use to which the result of these experiments can be put we cannot yet say; but they certainly

are of great "scientific" interest. The exact reason to account for these results is not yet fully understood; possibly it is due to the purity of the water, or again, possibly it is due to the evolution of heat caused in the water by the action of Mrs. Dickinson's "radio-activity"; but these are merely suggestions of the writer's, and may, or very likely may not, be correct.

Substitutes for Food.—Many interesting experiments have been carried out by Mrs. Dickinson for making certain substances into substitutes for various foods.

Owing to the exceptional properties of the "Radio-Active" Water, many inferior and more or less raw substances have been *cleansed and improved* and made suitable to combine with other things, also treated, to form food "substitutes."

This work is still in its experimental stage, but should it prove as satisfactory as the "treated" vegetables have done (mentioned a little later), then it should be of untold value for many purposes.

Tar.—This valuable by-product from coal has in a small way been experimented upon in connection with the New Activity by Mrs. Dickinson, who states: that wood girders and other supports, as used in engineering, pier construction, etc., after being painted with the "Radio-actively" treated Tar, possess a longer life than they otherwise do in the normal way; she also says that these things then to a certain extent possess Anti-corrosive properties, which in the case of sea-water, for instance would appear important.

Mrs. Dickinson adds that she has also noticed that Tar which has been treated with the New Activity by her method is found to afterwards acquire a beautiful hard enamel-like surface.

Incidentally, just a little experimental work has been done with the aniline dyes from Tar in conjunction with this "Radio-active" treatment, and most beautiful tints and colours have been obtained, so Mrs. Dickinson says, and which she believes are of a permanent nature. However, not much work has been done under this heading beyond a few experiments; but should it be found that the properties of this New Activity can be utilised to their

best upon Tar, then there should be a great commercial future ahead for the “radio-actively” treated Tar.

Vegetables, the Preservation of.—Quite recently Mrs. Dickinson has commenced a course of experiments with regard to the “preservation of dried vegetables” and other food stuffs. This has especially been done with a view to supplying “fresh” vegetables to the fighting forces of the British Army in all parts of the Globe. Fresh vegetables cannot always be obtained for their use, and certain vegetables have consequently to be dried here and then sent out for their consumption.

These vegetables have been duly prepared and rendered preservative, so that even after months of storage they have only just to be warmed up in water to make them almost resume their natural condition and freshness.

Certain firms already supply such foods, which have been prepared and chemically treated. Now Mrs. Dickinson has found a process, too, by which she has been able to do this easily, but with the action of her “radio-active” water only, and not with the use of any destructive chemicals.

Cabbages, carrot, beetroot, and potatoes have been successfully treated in this way, which after some elapse of time it has been found can be brought back to their apparently original condition in size and freshness by simply being warmed up in ordinary water in the usual way.

Specimens of these dried vegetables, made by the “radio-active” process, have been submitted to leading London firms, who have stated after examination that their condition was excellent, and that they would be pleased to entertain the matter further, provided that the cost of the “radio-active” treatment was not too high. As this does not happen to be the case, Mrs. Dickinson, at the time of going to Press, is endeavouring to place these “Dried Vegetables” upon the market on a commercial footing, so that they can be supplied to any one travelling or touring in different parts of the world, and in all seasons.

The writer, who witnessed Mrs. Dickinson’s experiments, certainly noted how these dried vegetables (which

had originally been prepared with the "Radio-Active" Water only) came back to their practically original condition by simply being soaked in water, even after months of keeping, and they certainly seemed as well perfectly satisfactory in taste and in every way.

Here again is demonstrated the general "preserving" powers derived from the New Activity; and it follows naturally that the proteids or food value of the vegetables under this process must probably be higher than when large quantities of sugar or strong chemical preservatives have to be used.

Water treated with the "New Activity."—Water possessing "Radio-Activity," but of the mineral inorganic nature, is, as we know, found at Bath, Buxton, below the London clay, in the River Avre, and also in the River Clitumnus, in Italy, and at other places.

These waters were ultimately found to be "Radio-Active," as had been originally suspected, from the fact that they in time turned glass blue.

The natural "Radio-Active" waters from these or similar spots have not been utilised very widely for commercial purposes. In some cases beneficial therapeutic results have been obtained from their use, and in other cases they have been found to be burning, poisonous, and destructive.

However, ordinary water treated by Mrs. Dickinson's "Radio-Activity" (see pages 90, 103) has been found in all respects to be *totally different* to the "naturally found" inorganic "Radio-Active" Waters. To describe the many uses to which Mrs. Dickinson's "Radio-Active" Water could be put is practically an impossibility; but it may be said that wherever and for whatever purpose water is used, the Dickinson "Radio-Actively" treated water could probably be used more efficaciously.

In brief, we have already seen the use of Mrs. Dickinson's "Radio-Active" Water, where corrosion in boilers is concerned, in the manufacture of soaps, for making bread and antiseptics, for paper-cleaning, for agriculture, for breaking up ore, for wool cleaning, for purifying oil, and finally as a general cleansing agent, etc.

This "Radio-Active" Water is then one of the great

mediums by which Work can be done from the New Activity. Contrary to the natural inorganic “Radio-Active” Water, “Radio-Active” Water from the New Activity has been found to always be extremely useful for Medicinal and Therapeutic purposes. This “Radio-Active Water, like the Bath “Radiumised” water, is also aerated and bottled up and supplied as a “mineral” or table drinking water; and it has been found to contain most beneficial properties for Arthritis, and in the elimination of Gout, Rheumatism, acidity, etc., for which many testimonials have been received from the Medical Profession and others. (See reports, page 189.)

Other advantages accruing from this “Radio-Active” Water are, that it can be easily obtained without having to go to Bath, Harrogate, Continental Spas, or similar places; that it can be prepared easily and freshly in large quantities, and at any time *direct* from Mrs. Dickinson’s crystals; and also, that up to the present the “Activity” imparted to it has been found to be *retained permanently* (at least water rendered “Radio-Active” over two years ago is still apparently just the same to-day, so Mrs. Dickinson says), are all very important factors.

Whereas in this last respect the “Radio-Active” drinking or Table waters made artificially from the mineral inorganic Radium have been found to lose their activity after a few days (refer back: page 37); and these waters, too, can only be obtained in limited quantities and at certain places.

Quite incidentally, excellent wine with high preserving qualities has also been made in conjunction with this “Radio-Active” Water. (See page 138.)

And it is further interesting to remark that from a brewing point of view the natural “Radio-Active” Waters have not proved very successful. Mrs. Dickinson is at the present time making arrangements to have her “Radio-Active” Water used in the manufacture of beer, and the results should prove satisfactory and highly interesting.

Much controversy has lately arisen as to the best way of actually detecting in water the presence of “Radio-activity.” Now in cases where the source of the water

is known there should be no difficulty, but in cases like that of Mrs. Dickinson's water, *where a marked effect is only observed to take place in "ordinary" water, after the insertion of a sealed tube containing a certain crystal*, it is extremely difficult to know whether the effect in the water in this latter case is due to "Radio-Activity" only, or to some other form of Activity, such as chemical or electrical for instance.

The writer has not yet arrived at a decision as how to best determine exactly when the water is charged (either partially or fully) by Mrs. Dickinson's process, or as to whether the water does in reality become "Radio-Active" *itself*,* or whether it is only its nature which has become altered in some way physically due to the action of Mrs. Dickinson's active substance (and which thus causes its new and unusual properties); but he is of the opinion that this could probably be tested, either—

(1) By bringing the "Radio-Active" charged water within the proximity of some form of a charged electro-scope; or

(2) By making a long exposure with some of it laid on a dry photographic plate, which would show its Radio-Activity.

However, W. W. Baggally, who in an experiment exposed some of Mrs. Dickinson's Radio-Active Water within a glass tube to a dry photographic plate, was unable to obtain any results indicating Radio-Activity, though very likely his exposure was not long enough; and, again, perhaps the water should preferably not have been contained in a glass tube, as the latter might have handicapped the range of action of any radiations emitted from the water; or

(3) Possibly this "treated" water could be brought in an open glass trough, say, between two metal plates connected to an extremely sensitive moving-coil-galvanometer (such as Griffin's; D'Arsonval), by means of which the "radio-activity" of the water could then be registered—provided that the "treated" water continued to emit "radiations," *thus ionising the air between the two metal*

* Meaning in the usually understood and appointed sense of the word.

plates, rendering it conductive—which result could probably be easily measured upon so delicate an instrument as that mentioned.

However, these remarks are only the writer's suggestions, and have yet to be actually "supported by experiment."

Wine made with the "New Activity."—Radio-Active water, spirit, and other things have in a small way been utilised in the manufacture of wines and liqueurs.

Mrs. Dickinson made a small quantity of these, just for experimental purposes, and found, she says, that they possessed from the "activity" an exceptional "brightness," as well as obvious "high preserving" qualities.

Those who have drunk these wines have said that they were excellent; and, no doubt, judging from the general characteristics of the New Activity in other things, it would appear that its properties may be highly beneficial for wine making.

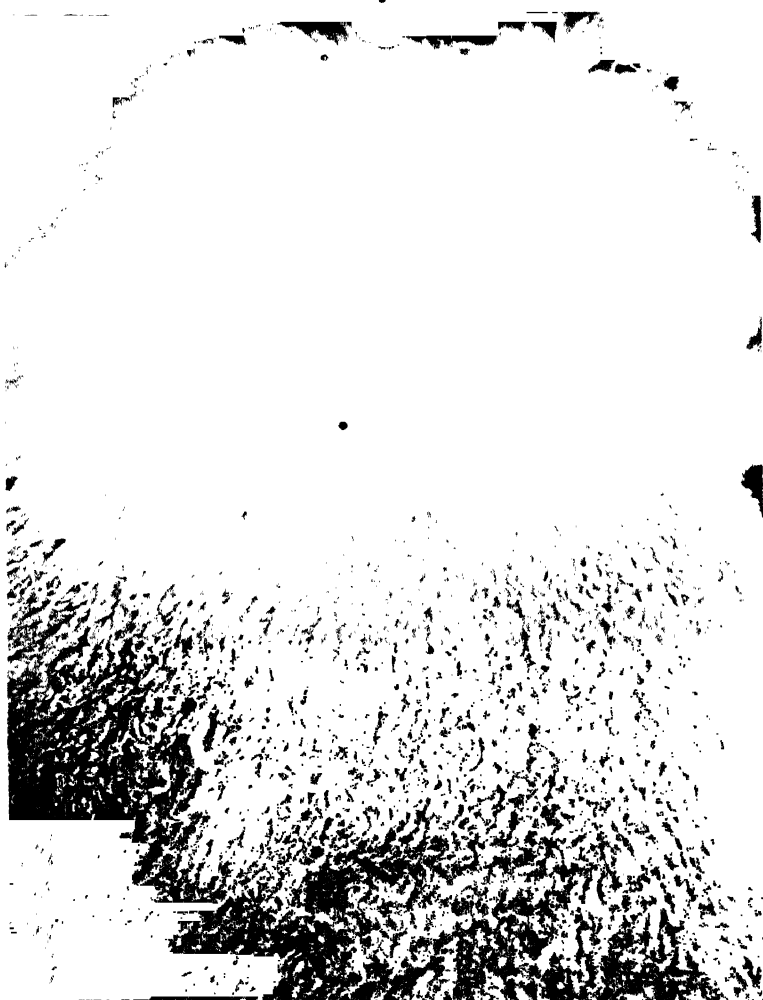
Wool Cleaning.—(Ref.: page 190.) The cleaning of Wool by the "New Activity" has also been found to be highly successful.

Mrs. Dickinson, in 1914, when experimenting upon some wool in a small way in the laboratory, found that with her special process (consisting only of "radio-active" water and "radio-actively" prepared soap), that even the dirtiest of wool straight from the sheep's back could be rendered beautifully white, clean, and pure in a short time only by a very simple method, and without the use of special machinery.

The finished wool, though perfectly white, was found to still retain its "natural" lanoline and oiliness, which, as chemists well know, in after years are necessary for the preserving of good wool; and it was found, too, that neither were the fibre, texture, or virtue of the wool apparently in any way impaired or affected by this "radio-active" process.

Now this cannot be said to be the case with the ordinary methods of wool cleaning at the wool mills, where the wool has to be scoured by means of an "ammoniacal lye"; that is, soft water with ammonia strongly in solution, the object of which is to remove the yolk or

PLATE No. 17.



Reprinted from Brighton and Hove Society, May 7th, 1914.

• A SHEEPSKIN.

NOTE.— The above photograph shows a dirty sheepskin, the top half of which has been cleaned, by being immersed in a solution of Radio-Actively treated soap and water. The bottom half shows the "natural" dirty state of the wool, which it is extremely difficult to clean. (See Article.)

fatty matter (consisting of condensed perspiration) with which the wool is covered, and which is a waxy substance with a sickly odour, containing potash salts, and lime. After which the wool has to be immersed in the heated "lye" for some hours, when it is then rinsed in special washing machines; and finally the wool has to be cleansed by being bleached with hydrochloric acid and sulphide of soda, and sometimes with soft soap and other chemicals, etc.

Now all of these, which, as can be readily seen, are both expensive and detrimental to the wool, are consequently done away with, and are not required in the wool cleaning by Mrs. Dickinson's "Radio-Active" process.

Mrs. Dickinson, as a result of her experiments, notified one of our largest wool factories in the North of England (*i.e.* W. Lupton and Co., Ltd., Pudsey) regarding the excellent results she could obtain by her process.

In reply they thereupon despatched to her a sample of filthy dirty wool to be cleaned by her method. This was at once performed, and the finally cleaned wool was very shortly returned for their inspection. In their report (see page 190), after examining the wool, they say, "The condition of the wool is all that we could wish."

So here again the Dickinson "New Activity" would appear to lend itself to great commercial use; while it is also interesting to note that the cleansing and preserving properties of the "radio-active" water are still further manifested in the treatment of wool.

However, the application of the "radio-active" process to "wool cleaning" on a *wide scale* is one to which Mrs. Dickinson hopes shortly to turn her *sole* attention, especially as she has been asked to do this by a large firm in Australia, where wool cleaning, as we know, forms such a gigantic industry.

At the moment of going to Press Mrs. Dickinson is still engaged in the "wool cleaning" by her "activity." And the writer certainly must admit that he has been most impressed by seeing the filthiest of dirty wool rendered snowy white, merely by its firstly being allowed to soak in cold "radio-active" water, after which it is washed for only a short time in hot water, in which a

little specially prepared “radio-active” cream soap has been dissolved ; when next it is rinsed in fresh hot water, and then finally allowed to dry, when it assumes its perfectly white and finished state.

The finished wool, after this simple process, certainly seems much better in comparison than that done in the ordinary way. In fact, it appears to the writer to in every way fulfill the claims Mrs. Dickinson makes regarding her “radio-active” process for “wool cleaning.”*

Zinc-Sulphide.—Zinc sulphide and other luminous paints are beginning to be widely used in the manufacture of watches, scientific instruments, etc. For, after having been exposed to the light, zinc sulphide, as we know, remains luminous in the dark, and consequently up to the present it has been used on compasses, watch-hands, and other instruments intended for night use.

Zinc sulphide, in spite of special treatment, has been found when in use upon aeroplane instruments to lose something like 70 per cent. of its efficiency after only three or four months use. Even the so-called “radium” paints behave in this way.

On account of the luminosity of Radium and its scintillations in the dark, one would have expected that Radium should be especially successfully applied to paints for these purposes.

However, the radium paints, as just stated, have not proved very successful in actual use.

In the case of the New Activity, Mrs. Dickinson has not yet been able to make or treat from her “radio-activity” a permanently luminous paint, but she is still experimenting, and hopes in time to be able to accomplish this, especially for aeroplane instruments, as she has particularly been requested to try experiments for this purpose.

Miscellaneous Uses.—In addition to the multitude of things mentioned in this chapter, which Mrs. Dickinson has treated by her “radio-activity,” there are many other things which have also been treated, but which have not been individually dealt with.

* Refs. : See Brighton and Hove Society, April 16, 1914 ; May 7, 1914, etc.

Mrs. Dickinson's experiments upon all these various things have been carried out with a two-fold purpose, namely: firstly, to arrive at any *scientific* properties which her "radio-activity" may be found to possess; and secondly, to see if they have any practical and commercial value.

Among the chief of the unmentioned things, so Mrs. Dickinson says, are:—

"Radio-active" ink, claimed to be non-corrosive.

Good rubber has been reclaimed from old rubber by her process.

Wood pulp, like the paper pulp, has been whitened by the "radio-active" water.

"Waste teas" have been purified and separated.

Tobacco has also been purified and rendered better.

Coal substitutes have also been made, and then improved upon by the New Activity.

Felt has been improved upon.

Milk has been experimented upon with a view to preserving it.

Straw has been partially whitened by the action of the "radio-active" water attacking the coating of silica, after which the straw can be used in paper making.

Clay has been improved upon for brick making, etc.

The Concluding Remarks from the Author's Own Observations.—The investigating of and the research into the "New Activity" have been very complex matters. The author started upon these some time ago with no previous knowledge whatsoever of the "New Activity," and with only a moderate knowledge of Radium and the other "radio-active" elements.

From the outset his sole attention has been given to ascertaining whether there is really any "activity" at all present in this substance claimed to be a *new* discovery in "radio-activity."

Much of the general work which has been referred to represents work which has been carried out by Mrs. Dickinson *alone* during recent years, and the writer can therefore do nothing else but accept and work on the facts as stated to him by Mrs. Dickinson, the discoverer.

However, the writer from the first has had many

facilities given him for “ putting to the test ” the various assertions and claims made by Mrs. Dickinson.

For instance, to prove that the crystals produced scintillations, his own Spinthariscopes, which has been dealt with elsewhere (pages 70, 71), was a specially made *test* instrument. This spinthariscopes, which was mounted with a particle of the “ New Activity ” substance, has always given bright scintillations ; and on account of this it has been one of his most infallible guides.

Then again, some of his experiments with the “ New Activity,” such as his observing under *test* conditions the capability of *some* of the crystals to discharge a charged gold-leaf electroscope, have, like the results obtained in the spinthariscopes, much impressed him ; and these results have also again confirmed the presence of “ radio-active ” rays.

It may also be mentioned that Mr. W. W. Baggally has often seen the scintillations produced by some of Mrs. Dickinson’s “ radio-active ” substances in a spinthariscopes, and he, too, has witnessed their effect in discharging a charged electroscope.

The photographic action obtained by Mrs. Dickinson upon photographic plates, together with those results obtained by others later, have still further substantiated Mrs. Dickinson’s claims to possessing “ radio-active ” crystals.

As has been remarked before, Mr. W. W. Baggally (the senior “ research investigator ”) has *independently*, and under *test* conditions, proved that *some* of Mrs. Dickinson’s crystals “ fog ” and produce effects upon photographic plates, *even through glass, paper, and lead* (already dealt with, pages 67, 68).

The small experiments in analytical chemistry, etc., which the author has conducted upon Mrs. Dickinson’s crystalline substance, have not yet definitely informed him what, as one of our leading geologists once said, “ This unknown substance or mysterious compound ” may actually be. (Ref. : page 195.)

The actual producing of certain *lines and markings upon glass plates* by the “ New Activity ” in the presence of both Mr. W. W. Baggally and the writer have very

much interested them ; and it has naturally led the writer to read up and consult works upon the " Trails " produced by Radium in " Aqueous Atmosphere " experiments.

The similarity between these trails and those lines produced by Mrs. Dickinson's " radio-active " substance is most marked. (Fully dealt with, pages 71, 147-156.)

And lastly, it was owing to the numerous reports, resulting from experiments carried out in various branches with the " New Activity " in different *practical ways*, that the author was led to himself experiment upon such things as corrosion, oil, water, freezing, germination of plants, etc. (which have all been individually dealt with elsewhere).

And, judging from some of his own experiments, as well as certain others mentioned in reports as certified by independent persons, and from other scientific characteristics found by Mr. W. W. Baggally and the writer, together with those facts found by Mrs. Dickinson and her assistants, the writer has naturally been led to believe there certainly must be some extraordinary " radio-activity " present to account for all the different results which have been obtained.

With this hypothesis as a working basis, the writer consequently turned his attention in endeavouring to see whether this " activity " claimed to be " *new* " was either :

- (1) Something *new* ; or
- (2) Some form of Radium ; or
- (3) Whether it could be associated with Radium, or with any of the *other* " radio-active " bodies.

As all the radiferous minerals have now been searched, and this " activity " has not been found to be among them, it certainly looks as if it may be something entirely *new*.

From the reasons given in this little book, and from the fact that authorities on the subject of " radio-activity " have not recognised Mrs. Dickinson's crystals as any form of the " radio-active " bodies they had ever known of, and from certain suggestions supplied to him by experts on Radium, in conjunction with his own observations, and relying on the data being accurate as given to him by Mrs. Dickinson, the writer has then not been able

as yet to associate this “ New Activity ” with any “ active substance ” known ; and he is, therefore, still engaged in his research with a view to accurately determining this.

Should this “ active substance,” which has been called the “ New Activity,” prove to be something *new* and as yet undiscovered—or something already known, but highly capable of receiving “ induced ” activity—or something known, but possessing an unknown and hitherto unrecognised activity . . . and yet, whatever it may be, be able to perform upon a large scale the wonders and apparent miracles that it undoubtedly does perform upon a small scale—then the writer cannot but foresee for the “ New Activity ” a gigantic future, and with the hope that this “ New Activity ” (or “ radio-active ” substance of Mrs. Dickinson’s) will be thoroughly and rigidly investigated “ scientifically ” ; and that every possible opportunity of any results accruing from it will be put to their fullest use, he concludes this first general survey upon what Mrs. Dickinson calls “ A Newly Discovered Radio-Activity.”

The author hopes to follow this introductory book with another, dealing purely with the scientific facts that may come to light during further investigations. The book will be devoted to matters too technical to be brought within the scope of the present work.

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FOR REFERENCES AND BIBLIOGRAPHY, ETC., OR FOR
NOTES TO PART II., CHAPTER II.

The full references to work mentioned in the past chapter will be found in the following Reports, etc., from which the facts were taken, unless otherwise stated.

A PAPER
BY
W. W. BAGGALLY,
•
ON
THE ANALOGY OBSERVED
BETWEEN
THE FORM OF CERTAIN LINES ON GLASS PLATES
(caused by Mrs. Dickinson's "Radio-Activity")
AND BETWEEN
CERTAIN TRAILS PRODUCED BY RADIUM IN "AQUEOUS
ATMOSPHERE"
(from the experiments carried out by C. T. R. WILSON, F.R.S.).

NOTE.—This Lecture was written by W. W. Baggally, Summer, 1918, and first publicly read, December 9, 1918. It is referred to on page 75 of this book.

A PAPER
BY
W. W. BACGALLY
UPON
MRS. DICKINSON'S
NEW RADIO-ACTIVITY.

ON the 7th March, 1913, Mr. C. T. R. Wilson, F.R.S., read a paper before the Royal Institution of Great Britain on "Photography of the Paths of Particles ejected from Atoms," by a method which he had devised.

Mr. Wilson says in his paper * :—

"The velocity of the fastest 'beta' particles or rays of Radium approaches very nearly that of light; that of the 'alpha' ray or particle, which is a positively charged Helium atom, is considerably less, but exceeds 10,000 miles a second. It is true it has been found possible by two different methods to detect effects arising from the action of a single 'alpha' particle.

"Thus Rutherford introduced a method in which effects due to the 'ions' set free along the path of a single 'alpha' ray could be detected by an electrometer; again, in the Crookes spinthariscopes, each 'alpha'

* Refs. : *Proceedings of Royal Institution of Great Britain*, No. 107, Part III., Vol. xx., November, 1914.

Note.—See also *Proc. Roy. Soc.*, A87, 1912.

particle causes a star-like point of light to flash forth momentarily when it strikes the zinc-sulphide screen. But it was not found possible by such methods to detect effects from a single 'beta' particle or ray.

"It is plain that a great advance would be made if it were possible to induce each 'alpha' or 'beta' particle to leave a visible trail behind it along its whole course, and to photograph this trail.

"This is what is accomplished by the method now described.

"Each 'alpha' or 'beta' particle, in the course of its flight through a gas like air, traverses large numbers of the atoms of the gas. According to modern theories, such as those developed by Sir J. J. Thomson and Rutherford, each atom may be regarded as a sort of miniature solar system, in which the planets are represented by negatively charged corpuscles or electrons. The forces with which we are concerned being, of course, electrical, and not gravitational.

"When either an 'alpha' or a 'beta' particle passes near one of the members of the system, there are forces tending to deviate the flying particle from its otherwise straight course and to cause disturbances in the path of the planetary electron; these may be violent enough to cause the electron to escape from the system. An electron thus set free will become attached finally to some other atomic system, which thus acquires a negative charge, whilst the atom which has lost an electron has been left with an excess of positive electricity.

"We thus get positively and negatively charged atoms or 'ions,'—indeed, a method of making visible the individual 'ions' has long been available.

"Molecules of water or of other vapours attach themselves more readily to 'ions' than to uncharged atoms or molecules.

"Thus in the absence of other nuclei on which vapour can condense more readily, such as those called dust particles by Aitken, it is possible to arrange that every free 'ion' shall act as a nucleus and cause the condensation of water vapour, whilst none condenses elsewhere.



FIG. 1.

(Ret. page 151, line 30.)



FIG. 2.

(Ret. page 152, line 27.)

"Each invisible 'ion' may thus be converted into a visible water drop.

"The advance which I have recently succeeded in making in the condensation method of studying ionisation is this :—

"The ions are now captured and converted into visible water drops in the positions which they occupied immediately after their liberation by the ionising agent ; the cloud of drops is then at once photographed.

"Thus the invisible trail of 'ions' left behind along the course of any ionising particle is converted into a visible line of cloud, of which a photograph is secured.

"In this way a record is obtained of the path of each projectile, by making visible the atomic wreckage it has caused in its passage through the air, or other gas."

Mr. Wilson gives in his paper a description of the apparatus that he used, and then proceeds to say :—

"If the clouds formed by condensation on the 'ions' are to be photographed, it is necessary to expose them to an instantaneous illumination of great intensity while the camera is in position. The instantaneous illumination is obtained by a Leyden Jar discharge, the arrangement being essentially the same as that used by Lord Rayleigh in photographing jets of water, and by Worthington in his study of the splash of a drop."

Mr. Wilson points out a most remarkable feature of the tracks of the "alpha" particles, viz. their general straightness. Sudden bends, however, are to be observed sometimes at their ends.

He gives pictures in his paper of tracks or trails produced in the water vapour by the passage of the "alpha" and "beta" rays of Radium.

I have copied a few of these pictures.

The form and character of the tracks therein shown have a bearing on my investigation of effects produced by Mrs. Dickinson's Radio-active substance on plates of glass, as I will presently show.

The first picture I would refer to is an enlargement of two of the tracks, one of them having two sudden bends at one end. (See Fig. 1.)

Mr. Wilson makes the following observations when referring to the above picture :-

“The path is otherwise straight except very near its end. Now the ‘alpha’ particle has thousands of encounters with atoms of the gases of the air in each millimetre of its course, by which ionization is brought about, as we know, from measurements made by the electrical method ; and in accordance with this, the cloud particles (which are simply ‘ions’ magnified by condensation of water) are so closely packed that they are not separately visible in the photograph. It is remarkable that only two encounters out of the many thousands occurring in the course of its flight should succeed in deviating the particle visibly from its course, and that in these cases the deviation should be quite large.

“The ‘alpha’ particle in passing near one of the electrons of an atom may impart to it sufficient energy to cause it to escape from the atom, whilst on account of its own enormous momentum it is not perceptibly deviated from its course. We can thus understand the general straightness of the tracks.

“The sudden deviations must be due to encounters of a special kind.

“According to Rutherford’s view, such large deviations would be caused by the ‘alpha’ particle passing near the centre of the atom where he supposes the positive charge to be concentrated.

“What is perhaps the most interesting feature of the particular track I have been describing remains to be mentioned.

“At the second of the two bends there is a distinct spur, which one can hardly interpret otherwise than as being due to the recoil of the system which has caused the deviation of the particle.”

The next two photographs show the effect produced in the cloud chamber by a trace of Radium emanation—the radio-active gas, which is the first product of the disintegration of Radium. (See Figs. 2 and 3.)

Each cloud ray is a visible record of the conversion by expulsion of an “alpha” particle of a single atom of the emanation into an ionised atom, which is thus able

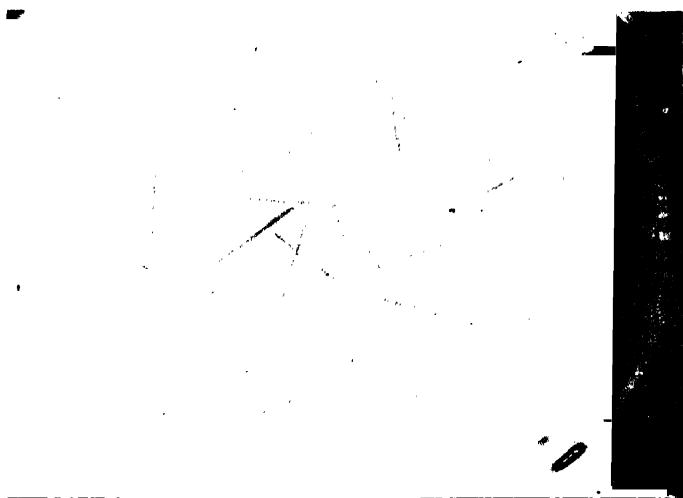


FIG. 3.

(Ref. page 152, line

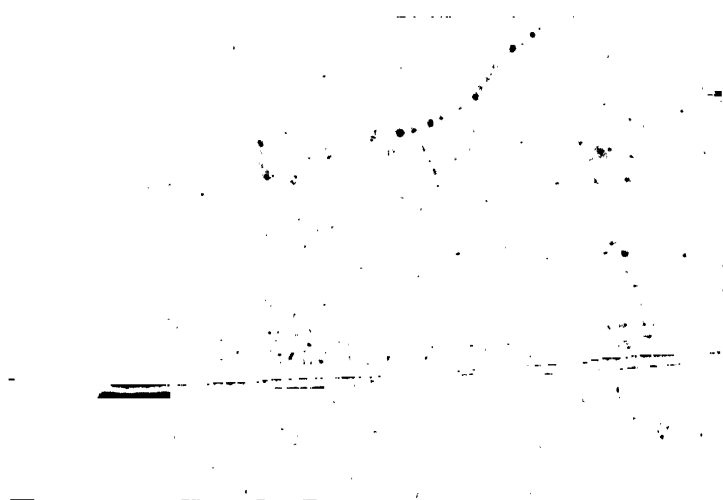


FIG. 4.

(Ref. page 152, line 38.)

to attract to itself the water vapour, and thus become visible.

Mr. Wilson also gives a picture of the final portions of the tracks of an "alpha" and a "beta" particle.

The "beta" ray shows much less intense ionisation, as indicated by the comparative densities of the clouds; and its devious path forms a great contrast to the straightness of the "alpha" ray. (See Fig. 4.)

One of the properties which Mrs. Dickinson claims that the substance which she has discovered possesses is that of penetrating glass.

To demonstrate this, she places a small portion of the substance on a glass plate, and its action on the glass is then examined through a microscope.

I had been engaged for some time in an investigation of the above nature when I detected some lines on the glass, which, by their absolute straightness, impressed me greatly.

I here give a picture of these lines.



FIG. 5.



FIG. 6.

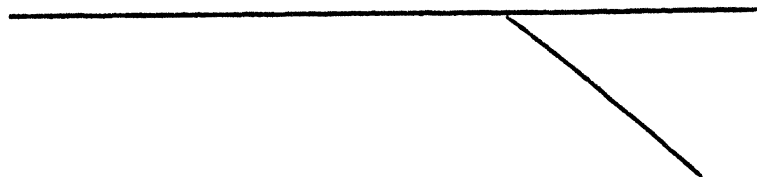


FIG. 7.

It is difficult to conceive how these lines, microscopic in their thinness, can have been produced artificially.

I had examined the plates of glass on which they appeared through the microscope before my investigation, and no lines were visible.

It was only after Mrs. Dickinson's substance had been placed on the glass that they made their appearance.

Some of the lines were single ones, see Fig. 5.

Others were parallel to each other and close together, see Fig. 6.

And yet others had a shorter line issuing exactly from a point in the body, if I may say so, of the longer line, see Fig. 7.

I have detected several of these lines.

They are absolutely straight, and do not cross one another.

I continued my investigation, and subsequently detected what I may call clusters of lines, as shown below :—

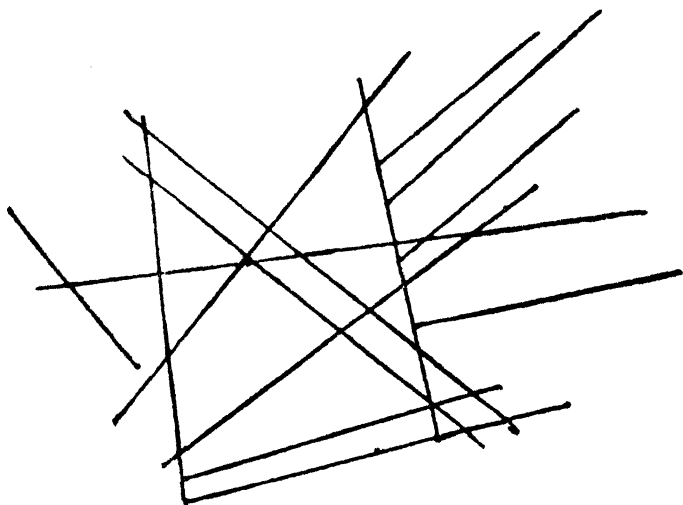


FIG. 8.

I attach great importance to these.

Their close resemblance to those which Mr. Wilson observed in water vapour, see Figs. 2 and 3, is remarkable.

They show radio-activity in Mrs. Dickinson's substance.

They leave an impression on the glass which is comparatively permanent, and they appear to indicate a *new*

method of showing the paths of motion of "alpha" rays other than that through water vapour devised by Mr. Wilson.

I have been in correspondence with one of our most eminent men of science respecting the claims of Mrs. Dickinson to having discovered a new radio-active substance.

It was my intention to send to him the glass plates on which the lines had appeared, but before doing so it occurred to me to re-examine the plates under the microscope. To my surprise the lines had disappeared.

I therefore tried fresh experiments, obtained new lines, kept the plates for a short time, and found that these lines also disappeared.

I wrote to the Professor to whom I have referred, and gave him an account of my discovery of the lines and their disappearance. I received a reply from him, from which I give some extracts:—

"What you say about the lines on the plates is interesting.

"It suggests that the action takes place in the ultra-microscopic film of moisture or condensed air coating the surface of glass, rather than in the glass itself. Indeed, in the glass itself radio-active lines would be very short, as you know from Joly's paper, but in the superficies they would be longer. It is important to measure their length. They usually terminate abruptly.

"You see, in the boundary between solid and gas there must be an intermediate region which is neither solid nor gas, but a shading off through a semi-liquid state from one to the other.

"The thickness being comparable to 10^{-8} centimetres, or perhaps ten times as thick as that in some cases.

"The phenomenon being evanescent rather increases its interest.

"These lines that you speak of may be expected to give much more definite information than mere Scintillations; and, moreover, the information may be of a quantitative kind.

"To make the lines permanent perhaps the best plan would be to clamp down a speck of the material with

some kind of cover, say a microscopic cover lid or something of that kind.

“ Perhaps the lines could be obtained between two such cover lids, one above, one below.”

I am now trying experiments, and following the suggestion of covering the material with a microscopic lid, etc.

My experience so far does not appear to lead to the conclusion that the action takes place in the film of moisture or condensed air coating the surface of the glass. It is true the lines disappear, but they do not do so till after the course of two or three days.

The lines do not disappear when the plates are in a warm room, nor when they are rubbed over by a cloth.

I attach importance to the analogy which I have shown exists between the “ form ” of the lines obtained by Mr. Wilson through the “ ionisation ” in water vapour, and the “ form ” of the lines produced by placing Mrs. Dickinson’s Radio-active crystals on glass.

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TABLES

PLATE 0.

TABLE SHOWING SYMBOLS AND ATOMIC WEIGHTS OF THE ELEMENTS.

Element.	Symbol.	Atomic weight.		Character.
		Oxygen-16.	Hydrogen-1.	
Aluminium...	Al	27·1	26·9	Metal.
Antimony ...	Sb	120·2	119·2	Metal.
Argon ...	A	39·88	39·56	Colourless gas.
Arsenic ...	As	74·96	74·36	Solid, with some metallic properties.
Barium ...	Ba	137·37	136·28	Metal.
Bismuth ...	Bi	208·0	206·4	Metal.
Boron ...	B	11·0	10·9	Black solid.
Bromine ...	Br	79·92	79·28	Reddish-brown liquid.
Cadmium ...	Cd	112·4	111·5	Metal.
Cesium ...	Cs	132·81	131·75	Metal.
Calcium ...	Ca	40·07	39·75	Metal.
Carbon ...	C	12·00	11·91	Black solid.
Cerium ...	Ce	140·25	139·1	Metal.
Chlorine ...	Cl	35·46	35·18	Greenish-yellow gas
Chromium ...	Cr	52·0	51·59	Metal.
Cobalt ...	Co	58·97	58·5	Metal.
Columbium	•Cb	93·5	92·76	Metal.
Copper ...	Cu	63·57	63·06	Metal.
Dysprosium	Dy	162·5	161·2	Metal.
Erbium ...	Er	167·7	166·36	Metal.
Europium ...	Eu	152·0	150·8	Metal.
Fluorine ...	F	19·0	18·8	Faintly yellow gas.
Gadolinium	Gd	157·3	156·05	Metal.
Gallium ...	Ga	69·9	69·34	Metal.
Germanium	Ge	72·5	72·0	Metal.
Glucinum ...	Gl	9·1	9·03	Metal.
Gold ...	Au	197·2	195·6	Yellow metal.
Helium ...	He	3·99	3·96	Colourless gas.

Element.	Symbol.	Atomic weight.		Character.
		Oxygen-16.	Hydrogen-1.	
Holmium ...	Ho	163·5	162·2	Metal.
Hydrogen ...	H	1·008	1·000	Colourless gas.
Indium ...	In	114·8	113·9	Metal.
Iodine ...	I	126·92	125·91	Black solid.
Iridium ...	Ir	193·1	191·57	Metal.
Iron... ..	Fe	55·84	55·39	Metal.
Krypton ...	Kr	82·92	82·26	Colourless gas.
Lanthanum	La	139·0	137·9	Metal.
Lead ...	Pb	207·10	205·46	Metal.
Lithium ...	Li	6·94	6·88	Metal.
Lutecium	Lu	174·0	172·6	Metal.
Magnesium...	Mg	24·32	24·13	Metal.
Manganose	Mn	54·93	54·5	Metal.
Mercury ...	Hg	200·6	199·007	Liquid metal.
Molybdenum	Mo	96·0	95·2	Metal.
Neodymium	Nd	144·3	143·15	Metal.
Neon ...	Ne	20·2	20·03	Colourless gas.
Nickel ...	Ni	58·68	58·2	Metal.
Niton (radium emanation)	Nt	222·4	220·63	Colourless gas.
Nitrogen ...	N	14·01	13·9	Colourless gas.
Osmium ...	Os	190·9	189·38	Metal.
Oxygen ...	O	16·00	15·87	Colourless gas.
Palladium	Pd	106·7	105·85	Metal.
Phosphorus	P	31·04	30·79	Faintly yellow translucent solid.
Platinum ...	Pt	195·2	193·66	Metal.
Potassium	K	39·10	38·79	Metal.
Praseodymium	Pr	140·6	139·48	Metal.
Radium ...	Ra	226·4	224·6	Metal.
Rhodium ...	Rh	102·9	102·8	Metal.
Rubidium ...	Rb	85·45	84·77	Metal.
Ruthenium	Ru	101·7	100·9	Metal.
Samarium	Sa	150·4	149·21	Metal.
Scandium ...	Sc	44·1	43·75	Metal.
Selenium ...	Se	79·2	78·6	Black solid.
Silicon ...	Si	28·3	28·07	Black solid.
Silver ...	Ag	107·88	107·02	Metal.
Sodium ...	Na	23·00	22·82	Metal.
Strontium ...	Sr	87·63	86·93	Metal.
Sulphur ...	S	32·07	31·81	Yellow solid.
Tantalum ...	Ta	181·5	180·05	Metal.
Tellurium ...	Te	127·5	126·49	Black solid.
Terbium ...	Tb	159·2	157·9	Metal.

Element.	Symbol.	Atomic weight.		Character.
		Oxygen-16.	Hydrogen-1.	
Thallium ...	Tl	204·0	202·38	Metal.
Thorium ...	Th	232·4	230·55	Metal.
Thulium ...	Tm	168·5	167·16	Metal.
Tin ...	Sn	119·0	118·1	Metal.
Titanium ...	Ti	48·1	47·1	Metal.
Tungsten ...	W	184·0	182·5	Metal.
Uranium ...	U	238·5	236·6	Metal.
Vanadium ...	V	51·0	50·59	Metal.
Xenon ...	Xe	130·2	129·17	Colourless gas.
Ytterbium ...	Yb	172·0	170·17	Metal.
Yttrium ...	Yt	89·0	88·3	Metal.
Zinc ...	Zn	65·37	64·85	Metal.
Zirconium ...	Zr	90·6	89·9	Metal.

NOTES.—1. Columbium, also called Niobium.

2. Glucinum, also called Beryllium.

3. Holmium (?), believed to be a new member of the rare earth group of metals. Its existence has probably not yet been substantiated.

4. The Radio-Active bodies, Actinium, Ionium, and Polonium, though believed to be elements, have probably not yet had their Atomic Weights accurately and definitely determined, consequently they are not given in the above table.

PLATE 4.

A FAMILY TREE OF THE URANIUM-RADIUM FAMILY, AS FAR AS IT IS AT PRESENT KNOWN, IS SHOWN COMPLETE IN TABLE 1 BELOW.

1.

Substance and atomic weight.	Period of fall to half-value.	Radiations emitted.	Range of α particles in air at 15° C. Centimetres.
Uranium ₁ 238·5	6×10^9 years	α	2·50
Uranium ₂	2×10^6 years	α	2·90
Uranium X 230·5	24·6 days	$\beta\gamma$	
Ionium 230·5 ?	200,000 years	α	3·0
Radium 226·5	2000 years	$\alpha\beta$	3·30
Emanation	3·85 days	α	4·16
Radium A	3 mins.	α	4·75
Radium B	26·8 mins.	β	
Radium C	19·5 mins.	$\alpha\beta\gamma$	6·94
Radium D ₁	1·4 mins.	$\beta\gamma$	
Radium D ₂	15 years		
Radium E ₁			
Radium E ₂	4·8 days	β	
Radium F (Polonium)	140 days	α	3·77

The above table is by Prof. J. Cox (reproduced from his book, “Beyond the Atom,” p. 91).

NOTE.—The above table, though dealing more fully with the matter in question than we require, is nevertheless an identical copy of the original. As it will be seen, it contains very valuable information, useful for reference, etc.

NOTE.—See also Plate 5 at the same time.

A FAMILY TREE OF THE THORIUM AND ACTINIUM FAMILIES, AS FAR AS IT IS AT PRESENT KNOWN, IS SHOWN COMPLETE IN TABLE 2 BELOW.

2.

Substance.	Period of fall to half-value.	Radiations emitted.	Range of α particles in air. Centimetres.
Thorium 232.5	$3 \cdot 10^{10}$ years	α	2.72
— Mesothorium ₁	5.5 years	rayless	
— Mesothorium ₂	6.2 hours	$\beta\gamma$	
— Radio-thorium	2 years	α	3.87
— Thorium X	3.70 days	$\alpha\beta$	4.30
— Emanation	54 secs.	α	5.00
— Thorium A	.14 sec.	α	5.70
— Thorium B	10.6 hours	β	
— Thorium — $\left[\begin{array}{l} C_1 \\ C_2 \end{array} \right.$	60 mins.	α	4.80
— Thorium D	? 3 mins.	α $\beta\gamma$	8.60
Actinium			
— Radio-actinium	19.5 days	$\alpha\beta$	4.60
— Actinium X	10.5 days	α	4.40
— Emanation	3.9 seconds	α	5.70
— Actinium A	36.1 mins.	β	
— Actinium B	2.15 mins.	α	6.50
— Actinium C	5.1 mins.	$\beta\gamma$	5.40

PLATE 5.

TABLE SHOWING THE RELATIONSHIP BETWEEN QUANTITY AND AVERAGE LIFE OF ALL THE TRANSITION FORMS EXISTING AS PRODUCTS OF URANIUM IN A MINERAL CONTAINING 1 TON OF URANIUM.

Name of substance.	Period of average life.	Quantity in milligrams.
Uranium	7,500,000,000 years	1,000,000,000 (=1 ton).
Radium	2500 years	333·3.
Emanation	5·3 days	One five-hundredth.
Radium A	4·3 minutes	One millionth.
Radium B	38 minutes	Nine millionths.
Radium C	30·5 minutes	Seven millionths.
Radium D	17 years	2·3.
Radium E ₁	9·5 days	About four thousandths.
Radium E ₂	7 days	About four thousandths.
Radium F (Polonium)	203 days	One fourteenth.

By F. SODDY.

(Table and explanation reproduced from Harnisworth's Popular Science. Page 1152.)

Explanatory Note.—“The Uranium Atom,” in its course of breakdown into Radium through the above transformations, in giving off “rays” loses in atomic weight at each stage of the disintegration.

“The Radium Atom” probably continues to break down until it reaches an atomic weight of 207, when it becomes “lead,” the ultimate product of the Radium Series.

REPORTS

(Report A. Page 50.)

THE XVIIITH INTERNATIONAL CONGRESS OF MEDICINE.

A Silver Medal was awarded to Dongor Hygienic Co. for the excellence of their exhibit of Antiseptics by the Jury appointed by the Executive Committee of the Congress.

THOMAS BARLOW,
President of the Congress,

LUCAS CHAMPIENMEVE,

London, August, 1913.

Chairman of the Jury.

(Report B. Page 50.)

INCORPORATED INSTITUTE OF HYGIENE.

No. 3211.

Date of Issue, September 13th, 1913.

1913.

This is to Certify that the "Dongor" Antiseptic Perfumes of Messrs. The Dongor Hygienic Co., of Brighton, have been passed by the Examining Board of the Incorporated Institute of Hygiene as fulfilling the Standard of Hygienic Merit required by them, in evidence of which the Council have affixed the Seal of the Institute hereon.

This Certificate—awarded for the First year—remains in force subject to the Rules and Regulations of the Institute until the 31st day of December, 1913, after which date a New Certificate if applied for will be granted only if the standard of quality or merit has been maintained.

Issued this Thirteenth day of September, 1913. By order of the Council.

V. GRANT RAMSAY,
General Director and Secretary.

The conditions under which this Certificate is granted may be had on application from the Secretary of the Institute of Hygiene, London, W.

(Report C. Page 67.)

REPORT ON PHOTOGRAPHIC EXPERIMENTS.

Conducted by F. J. Tanner, Photographer, St. James' Street, Kemp Town, Brighton.

The process of taking the photograph was through two pieces of aluminium, the tube being placed between the needle resting upon two matches on the top of the metal, the sensitive plate upon top of all, and kept in dark room for twelve hours.

N.B.—This statement has been certified to the writer as accurate by the above photographer.

(Report D. Page 69.)

Re *Spinthariscopes* examined by Sir William Barrett, F.R.S.31, Devonshire Place, London, W.,
May 1st, 1917.

Extract of letter received by Mrs. Dickinson from Sir William Barrett, F.R.S. (Referring to Radio-active particle seen through the Spinthariscopes.) He says:—

"... We tried the Spinthariscopes, and were most successful. When it was properly focussed and we had been some time in the dark, the sparks were quite distinct, and the effect the same as a particle of Radium bromide; but whether the effect was due to radium or not I had no means of knowing."

(Report E. Page 72.)

REPORT OF EXPERIMENT OF MARKINGS PRODUCED UPON GLASS BY MRS. DICKINSON'S RADIO- ACTIVE CRYSTALS.

At "Eastern House," 159, Marine Parade,
Kemp Town, Brighton, Sussex,
Thursday, February 7th, 1918.

Mr. W. Wortley Baggally brought with him some of his own plain glass slides (4 or 5) and examined every part carefully under the microscope, the glass contained no markings or scratches, being thus:—

(Here follows a drawing of a plain glass slide.)

"Dongor" radio-active crystals were then placed upon it, thus:—

(Here follows the same diagram of a glass slide with a few crystals upon it.)

After a short while certain new marks were observed on the glass, the crystals were removed, and the glass again carefully examined. It now contained some absolutely parallel straight lines (similar to those cut by a sharp diamond point), also a regular track of markings, all similar to one another right across the glass. All markings appeared clear, as if deeply cut or impregnated into the glass roughly, thus:—

(Here follows a diagram of the same glass plate with certain markings upon it. It is unnecessary to show them here, as they are elsewhere illustrated in the article on this subject, pages 74, 153, etc.)

Every phase of the experiment was conducted by Mr. Baggally personally, in our presence, and duly witnessed by us. The glass slide being as stated at the beginning and at the conclusion of the experiment, and not being touched or molested with in any way throughout the whole experiment. Also upon examination on the following day the glass still retained the same markings.

The above report is merely a copy from the rough notes taken by the author at the time of this experiment.

(Signed) FRANK A. HOTBLACK.

February 7th, 1918.

(Report F. Page 77.)

Laboratory Department, Cannon Brewery, Brighton,
February 22nd, 1918.

Mrs. Dickinson,
159, Marine Parade, Brighton.

Re *Experiment Illustrating the "Dickinson" Radio-Activity Discharging an Electroscope.*

[N.B.—An Electroscope is easily discharged by good Radium Bromide.]

I observed, under strict scientific test conditions, that upon bringing a weight of the "Dickinson" crystals within the vicinity of a charged electroscope that the diverged leaves fell.

Repeated experiments showed that the "Dickinson" crystals could immediately and completely discharge the electroscope (*i.e.* whether Positively or Negatively charged).

(Signed) FRANK A. HOTBLACK,
(Investigating.)

We have pleasure in certifying that we also each individually conducted the above experiment, finding the said very satisfactory results.

(Signed) W. H. BACON,
LUKE VENNER.

March 8-18th.—I have pleasure in stating that I also found the same above results.

(Signed) FREDK. D. DOWLING,
Mechanical Engineer,
36, Waldegrave Road, Brighton.

(Report G. Page 79.)

Brighton,
November 16th, 1917.

Re *A Freezing Experiment of Sample of Mrs. Dickinson's Radio-Active Water, November 7th-8th.*

This sample of water, together with a sample of our ordinary tap water (Brighton Corporation) was placed in our Cold Storage Department for 24 hours, the temperature being 27° F. After 24 hours, upon inspection, the sample of Mrs. Dickinson's water was found to be an unfrozen liquid containing a few floating needle-like crystals of ice, whereas the sample of our own water was a solid block of ice.

We have pleasure in certifying the above statement to be accurate.

(Signed) W. H. BACON,
Brewer and Chemist.

Witness : (Signed) FRANK A. HOTBLACK.

(Report II. Page 84.)

REPORT OF WEIGHING MRS. DICKINSON'S CRYSTAL, IN AN HERMETICALLY SEALED GLASS TUBE.

Experiment conducted by W. Baggally (Junnr.) and W. W. Baggally, 7, Sillwood Place, Brighton, Sussex.

Monday, July 15th, 1918. 8 P.M. Temperature 66.2 Fahrenheit. Weight 4.371 grams.

Wednesday, Aug. 7th, 1918. 8.5 P.M. Temperature 67.2 Fahrenheit. Weight 4.356 grams. Therefore loss in weight .015 grams in 23 days, from 15th July to 7th August.

Monday, 14th October, 1918. 7.45 P.M. Temperature 58.8 Fahrenheit. Weight 4.320 grams. Therefore loss in weight .036 grams in 68 days, from August 7th to October 14th, and in 91 days loss in weight .051 grams, from July 15th to October 14th. Showing an increased loss proportional to the number of days.

However, upon the tube being weighed again, 2nd November, 1918, at 3 P.M. Temperature 60 Fahrenheit, the weight was 4.34 grams. (The accuracy of this should be verified.) Therefore gain in weight in 19 days, from October 14th to November 2nd, 1918, .02 grams.

The tube has been weighed again on 4th November and the 7th, 1918, and the loss of weight has remained constant.

Note by F. A. Hotblack.—Any alterations in temperature have not been allowed for. The tremendous difference in the losses of weight is so appreciable as to suggest an abnormally rapid decomposition of the crystals. This can only be confirmed by time and further observation.

(Report I. Page 101.)

London, Brighton & South Coast Railway,
Medical Department, Brighton Works,
May 1st, 1917.

It gives me pleasure to state that I have used the "Dickinson" Antiseptic, with my doctor's approval (Dr. Shardlow, 41, Grand Parade, Brighton), after three operations for Antrum trouble had failed. I am now quite free and better in health than I have been for three years, and quite willing to submit myself to the most rigid examination.

With the approval of the Medical Officer, it has been used on Brighton Works for over four months, displacing all other Antiseptics. Considerably over 1,000 cases have been treated; but of all that number, only two could be classed as being unsatisfactory.

Any questions that I can answer relating to what has been done will be a pleasure.

(Signed) WM. L. GIRLING,
Officer in charge of Ambulance Department,
Brighton Loco. Works.

• (Report J. Page 102.)

MEDICAL CURES.

REPORT OF CURES OF ECZEMA BY MRS. DICKINSON'S "RADIO-ACTIVITY" APPLICATIONS.

The following are two cases of the cure of eczema effected by the use of my "radio-active" water and "radio-active" antiseptic cream and oils, etc.

A lady had severe eczema on her face, which was both painful and most unsightly. She had suffered from this

complaint for years, and had tried, in the first place, the usual creams and soaps, etc. She then underwent a special cure, and finally several expensive "X" ray applications by a Brighton doctor. All these treatments failed. She next tried my treatment of purifying the system by drinking continually the radio-active water, and at the same time applying locally creams and oils made strongly "radio-active" by me.

The skin of her face is now normal and healthy. She has been cured in four months, and also feels, she says, much better in her general health.

Note.—The names and addresses can be given upon application.

The next case is that of a poor woman who had eczema badly on the palm of one of her hands. Her statement is as follows:—

"It is with much thankfulness and gratification that I write and tell you that my right hand (which, as you know, was a raw and running sore of eczema, completely covering the palm, and between some of the fingers) is now, after a few applications of your "Dongor" Radio-active Ointment, perfectly healed. For months I had been under a doctor who failed to give me any remedy that would cure it, which caused me much distress, as I was unable to work and earn my living: and it is a great comfort to know there exists so certain a remedy as yours."

(Report K. Page 102.)

Copy of Original.

Grosvenor Hotel, London, S.W.1.

May 29th, 1917.

Dear Madam,

I am writing to thank you for your marvellous cure for Eczema. I had suffered from this awful disease on the face for 9 months, and had almost given up hope of curing it. You gave me some of your Antiseptic Cream, and I am thankful to say that in a week the wounds had completely healed, and in a fortnight there were no signs of it at all. Thanking you once again,

I remain, Madam,

Yours respectfully,

(Signed) CHARLES A. ROPER.

To Mrs. Dickinson.

(Report L. Page 103.)

Soldiers' and Sailors' Help Society,
27, Upperton Road, Eastbourne.

May 14th, 1915.

Madam,

I should be glad if you will send me by Monday next 56 large loaves of your bread. It is to be sent to Prisoners of War in Germany, and will be packed with other goods on Tuesday morning.

This bread keeps so very fresh that the men are able to enjoy it, even after three weeks' journey.

Yours faithfully,

(Signed) F. MACCARTIE,
Hon. Sec.

Extract. from the "Evening News," May 21st, 1915.

YEASTLESS BREAD FOR PRISONERS.

Fifty-six loaves of yeastless bread, known as Dongor Bread, were sent yesterday to British prisoners of war in Germany by the Soldiers' and Sailors' Help Society, of Eastbourne.

In their letter ordering the bread the Hon. Secretary said: "This bread keeps so very fresh that the men are able to enjoy it even after three weeks' journey."

The Dongor bread was first brought to notice by the *Evening News* last January, after it had been tested by being kept in the office of the *Evening News* for a fortnight.

It was invented by Mrs. Dickinson, of Brighton, a prolific inventor of things pertaining to health and hygiene. She persevered for months to produce a bread free from yeast of any sort.

Buckingham Palace,
19th May, 1915.

Dear Madam,

I am commanded by the Queen to thank you sincerely for the loaf of yeastless bread, which you have been good enough to send for her Majesty's acceptance.

I am,

Yours faithfully,

E. W. WALLINGTON,
Private Secretary.

Mrs. Dickinson, Eastern House, Brighton,

REPORT ON MRS. DICKINSON'S "RADIO-ACTIVE" YEASTLESS BREAD.

*From Joy's, Ltd., Biscuit, Bread, Cake
and Pastry Manufacturers,
Dawes Road, Fulham,
London, S.W.
and at Clarence Road,
Clapton, N.E.
April 5th, 1919.*

We have on several occasions made excellent bread, sweet and of good keeping quality, from a radio-action ferment prepared under the formula supplied by Mrs. M. Dickinson, of Eastern House, Marine Parade, Brighton, the only addition to the radio-action ferment being flour and salt. No yeast has been used in the manufacture of the bread.

JOY'S, LTD.
(Signed) GEO. A. FLÉCHE,
Managing Director.

June 14th, 1915.

F. W. Keeble, Esq., Eminent Scientist, says:—

In order to determine the action set up by the charged water you use, in setting up what is probably vinous fermentation, in the manufacture of your excellent bread, very careful investigation is necessary.

I should almost think a manolicular action was set up from the crocks, etc., which would, by their wonderful activity, claim an organic relation to radium (the crocks seem connected with active matter in the tubes).

Yours truly,
F. W. KEEBLE.

(Report M. Page 106.)

August 7th, 1918.

REPORT ON CEMENT MADE WITH MRS. DICKINSON'S RADIO-ACTIVE WATER.

Carried out by The British Portland Cement Manufacturers, Ltd., Sussex Portland Cement Co's. Shoreham Branch, Upper Beeding, Sussex.

Re Briquettes made on July 5th, 1918, with Tap Water.

Le Chatelier Expansion : 3.0.

[illegible]

Broken for Tensile Strength on
July 12th, 1918.

days' Strains, Neat : 700,
688, 650, 680, 730, 740.

verage Strains : 698.

3 days' Strains, Neat: \$10,
910, 790, 790, 800, 860.

verage Strains : 826.

*Broken for Tensile Strength on
August 2nd, 1918.*

7 days' Strains, Sand: 330, 270,
130, 340.

Average Strains : 267.

28 days' Strains, Sand : 290,
310, 370, 330.

Average Strains : 325.

Briquettes made on July 5th, 1918, with Flask Water.

(I.e. The "Flask" water refers to a quantity of the above Company's ordinary water, which was drawn off at the same time as the other and placed in a flask. The water in this flask was thereupon charged by a sealed tube containing Mrs. Dickinson's "Radio-Active" crystals, being suspended in it for about 45 minutes.)

Therefore results with "Radio-Active" Water:

Broken for Tensile Strength on
July 12th, 1918.

days' Strains, Neat: 650,
690, 790, 760, 750, 660.

verage Strains : 716.

3 days' Strains, Neat: 850,
860, 740, 750, 750, 850.

Average Strains : 800.

*Broken for Tensile Strength on
August 2nd, 1918.*

7 days' Strains, Sand: 250,
250, 310, 280, 320, 250.

Average Strains : 276.

28 days' Strains, Sand: 360,
310, 330, 340, 340, 360.

Average Strains : 340.

Yours faithfully,
p.p. The British Portland Cement Manufacturers, Ltd.,
(Signed) A. DOUBIE.

Mrs. M. Dickinson,
Eastern House, 159, Marine Parade, Brighton.

(Page 50.)

Reprinted from "Hove Gazette," March 21st, 1914.

THE DISCOVERY OF RADIUM.

Just at the moment when Sir William Ramsay's portrait is being presented to the University of London, and where Professor Collie, on Wednesday, in making the presentation, dwelt upon his great discoveries in the investigation of Radium, and when in Thursday's *Times* we read of traces of Radium being discovered in the brine baths of Droitwich, a fresh discovery is announced much nearer home, that is, in Brighton.

Mrs. Maud Dickinson, who is well-known as the inventor and proprietor of the Dongor antiseptic germicide, which is prepared by the mixing of certain oils from the East, has recently applied it in the form of Dongor soap. Happening to spread some of her soap cream on a piece of note-paper, she noticed that it afterwards turned brown. Then placing the note-paper with the brown spot under the microscope for observation, she discovered it presented an appearance of the crust of earth. This crust appeared to contain minerals of various beautiful colours in an active state. In fact, it had every appearance of answering to the description given of pitch-blende, the mixture of uranium, polonium, bismuth, lead oxides, iron, silica, manganese, cobalt, silver, and other minerals, as found in the mines of Joachimsthal in Bohemia, Rezbarya in Hungary and Colorado, St. Just, Redruth, in Cornwall, and in Grampound Rand. The radio activity was discovered to be very apparent, and small sparks like stars appeared from time to time on the purple, red, orange, green, and blue-black grounds, and here and there little tongues of phosphorescent fire.

These things have led to the conclusion that Dongor is Radium in another form, and this is borne out by the proved facts of the healing qualities of Dongor. The chief characteristic of Radium is its throwing-out power. It is this power which throws out impurities of the skin and causes Radium to be of such great value in curing tuberculosis, eczema, lupus, tumours, and other diseases, possibly cancer. One of the leading nurses of Brighton has been using Dongor in her nursing home for some time, and amply testifies to the marvels of its healing qualities. Others have used it for the cure of wounds and for various methods of antiseptic treatment of skin complaints. As a soap it has proved to exercise the same power of expelling all dirt and foulness from anything placed in its

solution, and doubtless has the same effect when applied to diseases. The value of the discovery by Mrs. Maud Dickinson, which is now being investigated by high scientific authorities, need not be commented on.

(Page 59.)

*Reprinted from "Sussex Daily News," Monday, January 22nd,
1917.*

BRIGHTON AND HOVE NATURAL HISTORY SOCIETY.

SERIES OF SHORT PAPERS.

Owing to the unavoidable absence of the President, Mr. H. L. Constable was voted to the chair at the meeting of the Brighton and Hove Natural History and Philosophical Society on Saturday. It was announced with much regret that through the illness of Mr. W. Layton, his lecture on Medicinal Plants was postponed until February 3rd. Mr. H. Cane also sent an apology for absence. The evening was devoted to short papers. The first was a very interesting paper by Mrs. M. Dickinson, M.R.I., on corrosion, illustrated by specimens and lantern slides. Mr. H. Davey gave a short account of Miss A. R. Teetgen's new book on profitable herb growing. Mr. A. W. Oke took for his subject the Bicentenary of Thomas Gray, and Mr. H. S. Toms followed with a brief account of valley entrenchments, illustrated with maps and plans. A hearty vote of thanks to the speakers, proposed by Mr. J. P. Mullan, seconded by Mr. I. Wells, brought a very interesting evening to a close.

Prevention of Corrosion.

In her paper, Mrs. Dickinson stated that corrosion from water deposits had exercised the minds of scientists and engineers a great deal, and the problem of preventing it formed a subject of world-wide interest. From the domestic kettle upwards we should all like to know that it was mastered. The latest observations and experiments pointed to the fact that the scaling of boilers, etc., was caused by galvanic action, or electro-chemical action, the water acting as the conductor or electrolyte to the metals it came in contact with. The tubes of locomotive boilers became pitted in a most deleterious manner, and corrosion was more pronounced when the water was at all acidulated or of an alkaline nature. It was in view of the great expense incurred in cleansing pipes, tubes, and

boilers, said Mrs. Dickinson, that she was led to experiment with her organic radio-activity. First of all the action of pure water on metals was very slight, and the immediate effect of the radio-activity on water was to purify it, and to precipitate all foreign matter in it and from the vessel that contains it. “ I undertook only last week an experiment at a mineral water factory,” she proceeded. “ The pipes and tap fittings had become quite made up with corrosion, causing a great amount of trouble and expense, yet when I treated a portion of the piping, which had corroded to nearly a quarter of an inch thick, I dissolved it away with some radio-active water in less than 30 hours, the result proving such a marvellous success that steps are being taken to adopt the method. Further, it is found that the metal of the pipes or boiler, if treated with radio-active water, becomes impregnated with it, preventing any further corrosion, as well as fortifying the metal. Other tests have been made with boiler tubes and urns which were badly incrustated by deposits from ordinary water accumulating for a space of over two years, also a new urn was tried using radio-active charged water, and no corrosion took place. All these tests have proved successful and have been verified by experts.”

(Report N. Page 111.)

INSPECTOR'S REPORT.

CORROSION IN BOILERS.

Madam,

I beg to report having made observation of the action of Radio-active water upon a cylindrical vessel, 9 ins. diameter by $11\frac{1}{2}$ ins. long, which had become badly incrustated by deposits from ordinary water, which had been accumulating for a space of over two years previous to the test.

This incrustation was found in places to be over $\frac{1}{4}$ in. thick, and consisted of two separate strata, the one of a light brown hue, and the other of a more obstinate character, resembling a thin filament of slate, for which the ordinary remedy would have been the application of Hydro-chloric Acid.

At the commencement of the test the vessel was nearly filled with Organic Radio-active water, heat being supplied by an electric radiator placed underneath. The water was allowed to boil at 212° F. for about 10 hours daily for a few weeks.

After a short time the incrustation commenced to come away in the form of a sandy substance (which has been bottled for inspection), and subsequently as thin flakes of a maximum thickness of $\frac{3}{8}$ in.

From observation of the test, it would appear that the rate of cleansing was about the same as the rate of incrustation had been previous to the trial. No deleterious effect was observed on the walls of the vessel, such as would have been caused had acid been employed as a cleansing agent.

This process would appear, primarily, to be most satisfactory for Marine Boilers; secondly, for Station Boilers furnished with condensers; thirdly, for Station Boilers *not* furnished with condensers; fourthly, for Locomotive work.

In the first and second cases great advantage would, I consider, be found in the adoption of Radio-active water, either in new boilers, where corrosion would be practically prevented, or in older ones, from which the scale would be gradually eliminated.

In case 3, the system would not be found as efficient as in Nos. 1 and 2, while case 4 presents difficulties, non-existent in the others, owing to the very extreme conditions which, it is agreed, obtain in Locomotive practice.

I am, however, satisfied that if this process be adopted, as indicated above, very beneficial results will accrue, and that its possibilities, which are great, can only be gauged by its introduction into actual practice.

I have the honour to be,

Your obedient servant,

(Signed) JOHN P. MAITLAND,

Locomotive Inspector, L. B. & S. C. R.

41, Preston Road, Brighton,

November 7th, 1916.

(Report O. Page 112.)

REPORT OF TRIAL OF WATER.

Charged with the " Dickinson " New Discovery of Organic Radio-Active Matter for the Prevention of Corrosion and Scale.

This is to certify that I have experimented with charged Water that has been rendered " Radio-active " by suspending in it Organic Radio-active Matter, as discovered by Mrs. Maude Dickinson, for the express purpose of ascertaining its

value in preventing scale and corrosion in boilers, condensers, etc., and find that it introduces into the water a counter-electrical force which overcomes Galvanic action, the cause of corrosion: it prevents formation of scale, and gradually eliminates old hard scale previously deposited, finally producing a clean heating surface, and at the same time protecting and rendering it immune from further corrosion.

The efficiency of its action is of the highest, and as no apparatus or labour is required in its application, a more economical or less expensive method is difficult to conceive.

(Signed) H. L. CONSTABLE,
Mechanical Engineer, L. B. & S. C. Railway.

10, Wakefield Road, Brighton,
October 28th, 1916.

(Report P. Page 113.)

N.B.—The “ Removal & Prevention of Corrosion,” from a test experiment with the Dickinson “ Radio-Active ” process.

From The Pulsometer Engineering Company, Ltd., Reading, Berks.

REPORT ON RADIO-ACTIVE TREATMENT OF FEED WATER FOR BOILER.

January 24th, 1919.

Mrs. M. Dickinson, Brighton.

Dear Madam,

We set out below particulars of the result of the trial which we carried out at these works, to ascertain the effect of your Radio-active matter on water used for boiler feed purposes.

The boiler on which the trial was carried out is a “ Babcock and Willcox ” water tube high-pressure boiler, fitted with super-heater.

The feed water we use is either from the Reading Town mains or from our own well. Both waters are hard, but the water from our well is considerably harder than the Reading water.

The boiler has to be laid off periodically for the removal of the very hard scale formed in the tubes and headers.

We use a high-pressure water turbine-driven rotary cutter for the removal of the scale, and in places the scale is so hard that the cutter jumps over it and leaves small ridges of scale inside the tubes.

When we started the experiment the boiler had been steaming for some time, and in places there was old scale which had not been removed by the previous cleaning, and new scale formed about $\frac{1}{16}$ in. to $\frac{1}{8}$ in. thick. This scale was very hard, and adhered very firmly to the surface of the boiler.

We set apart a special feed tank for the treatment. This tank was thoroughly cleaned out and painted inside, to make quite sure that there should be nothing in the tank to affect the water.

On October the 3rd, 1918, we suspended in the tank a padlocked perforated zinc container, which you kindly lent us on that date. In the container there were some sealed glass tubes, each tube containing a small piece of what we understand is organic Radio-active matter, discovered and prepared by yourself.

To make the test as severe as possible, we admitted only the water from our own well to this tank to be used for feeding the boiler.

The boiler which we tested is only used intermittently for testing purposes, when we test steam driven plant, so that it is only worked for very short periods at a time.

The container with the Radio-Active matter remained in the tank until December 30th, 1918. During this time the boiler had been under steam on nineteen separate days for a total of $126\frac{1}{2}$ hours.

We did not blow the boiler down whilst under pressure, but we left it to cool down, so as not to disturb any deposit inside the boiler; and when it was cold, we let the water off very gently.

When the boiler was opened out we found that not only were there no signs whatever of any fresh scale having formed, but that the old scale had come away from the boiler surfaces, and was found in pieces in the headers and in the mud drum at the bottom of the boiler. In the mud drum we found, in addition, soft mud, which, under ordinary conditions, would have been blown through the blow-off cock, as it was quite soft and showed no signs of caking.

In this soft mud we also found sections of the old scale, some sections showing clearly the contour of the tubes, and others the contour of the headers.

The internal surfaces of the boiler and steam drum were quite clean, except that they were covered by a thin layer of fine yellow dust, which was easily wiped off.

This shows that the Radio-Active matter apparently alters the physical condition of the water in such a manner that the solids left after the water evaporates are in the form of fine

powder, instead of the usual form of a hard scale adhering to the boiler surfaces.

The treatment does not cause any alteration in the chemical composition of the water, because, when tested by the usual hardness tests before and after treatment, the same hardness is registered.

Instead of having to chip the scale out of the boiler, which is a long and expensive business, we are now merely brushing and washing out the deposit, and the boiler will be closed up and put to work again.

We will work the boiler for the usual period, and when opened out for cleaning we will report the condition; and if you find it convenient to do so, we shall be only too pleased if you will call here to see it for yourself.

We remain,

Yours faithfully,

THE PULSOMETER ENGINEERING CO., LTD.

(Signed) J. BJÖRNSTAD,

Superintending Engineer.

(Report Q. Page 116.)

Re Germination of Plant Life.

The Manor House,
Tatsfield, Westerham, Kent.

Extract of letter from F. W. Keeble, Esq., April 23rd, 1916.

“ . . . The cake of loam you sent me I have experimented with with very good results. Especially in the case of groups of Sweet Peas the growth has surpassed the other most notably. I wish you would send me a little more, as now is the best time for testing. . . . ”

(Report R. Page 117.)

Wednesday, Feb. 20th, 1918.

Experiment conducted at 159, Marine Parade, Kemp Town, Brighton.

Re Experiment of the “ Dickinson ” Radio-activity and the germination of barley.

Note.—From a standard sample of “ 1916 ” Oregon Barley, 200 grains were carefully selected. Two “ Coldewes’ Patent Germinators ” were next each filled with 100 of these grains respectively. Both Germinators

throughout the experiment were under *identical* conditions (*i.e.* equal amounts of silver sand, water—subjected to the same light, temperature, etc.).

One Germinator was treated with ordinary water, the other with the same water rendered Radio-active by the "Dickinson" process.

1918.—Feb. 8th.—Experiment commenced.

Feb. 13th.—Barley found sprouting in both Germinators. Careful observation showed a higher percentage growing, and barley of a more advanced nature and of a stronger growth, in the *Radio-actively treated Germinator*. (Germinators received necessary attention.)

Feb. 20th.—Continuation of treatment, as far as "Coldewes' apparatus" permits.

General Remarks.—This experiment, particularly from the early stages from February 8th to 13th, showed that the plant growth of the barley was *stronger, greener, and healthier looking in the radio-actively treated germinator* than in the other. The whole experiment was witnessed, and under test conditions.

FRANK A. HOTBLACK,

Investigating the "*Dickinson*" Radio-Activity.

(Report S. Page 118.)

REPORT OF EXPERIMENT OF MRS. DICKINSON'S "RADIO-ACTIVE" TREATMENT FOR PLANT LIFE.

2, Powis Grove, Brighton,

June 27th, 1918.

Extract of letter :—

Referring to experiments conducted upon Roses grown with the "Dickinson" Fertiliser, and one Carnation grown with the "Dickinson" Radio-Active water, and the other with ordinary water, but both under identical test conditions.

W. H. Bacon says :—

" . . . I see the Carnation is 10 days in advance of the one watered in the usual way, and also that the stem is 6 inches longer than the other. . . ."

" . . . I consider the first Rose (Bessie Brown) grown by me, also with the "Dickinson" Fertiliser, was a record one for size. . . ."

General Remarks.—"I think from this little experiment that there is no doubt that the "Radio-Active" water promotes the growth of the plants, and also advances their flowering."

(Signed) WALTER H. BACON.

(Report T. Page 120.)

L. B. & S. C. R. ENGINE B. OIL, REFINED BY MRS.
DICKINSON'S NEWLY-DISCOVERED RADIO-ACTIVE
PROCESS.

London, Brighton and South Coast Railway,
Locomotive Department, Brighton Station,
April 11th, 1917.

Special Oil.

Dear Sir,

I beg to inform you that I have ridden on Engine 327, Driver H. Hampton, during the time this oil was being used, and took careful note of the effect upon the W. H. Donkey steam cylinder, the piston rods, and metallic packing, also big ends and driving crank pins, where this oil was applied.

I found it to be most satisfactory, particularly on the heated surfaces, and am of opinion that it is a good serviceable oil, and judging from the action upon the highly-heated piston rods of this engine, one would imagine it would be effectual in cases of troublesome bearings.

I would like further to add that since going back to the oil in general use, the metallic packing on this engine is not nearly in such good condition, and the glands are very troublesome.

This experimental oil shows no signs of corrosion, and I should be glad to see it tried for the lubrication of valves and pistons.

Yours obediently,

(Signed) E. PURSER,
Inspector.

Mr. E. S. Moore, *Running Supt.*

(Report U. Page 120.)

London, Brighton and South Coast Railway,
Locomotive Department, Brighton Station,
June 30th, 1917.

*Report of Experiment with Lubricating Oil, treated by the newly-
discovered " Dickinson " Organic Radio-Active Matter.*

Dear Sir,

I beg to report that samples of this oil have been issued to the following engines : Nos. 39, 91, 326, 327, and 328.

In each instance it has been used for W. H. Donkey steam

cylinder, slide bars, and piston rods, and in the case of 326 and 327 the six big bearings as well.

I have given this matter my personal attention, taking care that the oil should be kept separate, and in no case mixed.

I would call your special attention to its action on the heated piston rods, and also in the steam cylinder of the donkey, both of which, in my opinion, are the best practical tests an engine oil can have.

The oil is lighter, and therefore requires careful adjustment of the trimmings, and it seems to have lost its original stickiness, which in a little time corrodes, retards the syphoning, and makes the oil unreliable.

I desire also to point out that the donkey in each instance works well with it; in fact, equally as well as with cylinder oil, which is more expensive.

The drivers in question seem to be of one opinion, and I believe have already submitted their reports to you.

Yours obediently,

(Signed) E. PURSER,
Inspector.

L. Billinton, Esq., *Loco. Engineer.*

(Report V. Page 121.)

41, Preston Road, Brighton,
June 22nd, 1917.

W. Wortley Baggally, Esq.,
7, Sillwood Place, Brighton.

Dear Sir,

With reference to our conversation of yesterday (Friday), the oil to which you referred (*i.e.* Engine Oil "B" treated with radio-active water) was tried on L. B. & S. C. R. Engine 327, type 4-6-4T, with cylinders 22" x 28", coupled wheels 6' 7½" diam., working pressure 170 lbs./in.² and was fitted with "Robinson" superheater.

The oil in question was especially successful as a lubricant for the piston glands, which are on the outside exposed to the atmosphere, and on the inside are in contact with steam at a temperature ranging from 500° to 650° F. The ordinary (non-treated) oil "B" usually leaves deposits of a carbonic character in the form of small black specks upon the piston-rods. These were most conspicuously absent on the occasions when the treated oil was used, the rods becoming in appearance as bright silver. • The glands, too, behaved excellently whilst

the treated oil was in use, not giving the slightest trouble through blowing or other causes.

The engine-men spoke most highly of the treated oil, and considered same to be a great improvement on any they had previously used, not only for the above-mentioned parts, but also for the bearing surfaces upon which the oil had been employed by them.

With best compliments,

I am, dear Sir,

Yours very faithfully,

(Signed) JOHN P. MAITLAND.

(Report W. Page 122.)

ANALYSIS OF CASTOR OIL BEFORE AND AFTER TREATMENT BY THE "DICKINSON" RADIO- ACTIVE PROCESS.

December 3rd, 1917.

	Treated.	Non Treated.
Efflux, time for 50 cc. in Red-woods Standard Viscometres	1119"	1161"
Free fatty acid as Oleo ..	2.24%	3.36%
Specific gravity at 60° ..	964	963
Saponification value ..	176.0	176.0
Colour	Pale Yellow	Medium Yellow

(Report X. Page 123.)

The Sussex Cold Storage and Markets, Ltd.,

Russell Street, Brighton,

November 22nd, 1917.

Mrs. Dickinson,

159, Marine Parade, Brighton.

Oil Treated by the "Dickinson" Radio-Active Process.

The two samples of oil have been subjected to a temperature of 16° F. (14 to 18) for 24 hours. The untreated became cloudy, while the treated remained perfectly clear.

(Signed) C. J. ELMS,

Manager.

Cannon Brewery, Brighton,
Thursday, November 22nd, 1917.

I certify the above statement accurate: the difference between the dark cloudy oil and the pure almost transparent oil being very remarkable.

The untreated oil precipitated a large quantity of impure matter, while the treated oil contained no such impurities, being all through as bright as a crystal.

(Signed) FRANK A. HOTBLACK,

Witness: (Signed) W. H. BACON,

Cannon Brewery.

(Report Y. Page 123.)

The Brighton Pure Ice Co., Ltd.,
The Sussex Cold Storage and Markets, Ltd.,
Russell Street, Brighton,
March 4th, 1918.

Mrs. Dickinson,

159, Marine Parade, Brighton.

*Re Oil treated by the "Dickinson" Radio-Active Process for
Non-thickening at a Low Temperature.*

The four samples of oil, under identical conditions, were submitted to a temperature of 11° F. (10 to 12) for 75 hours. Then, upon inspection:—

No. 1 Sample.—Standard Pharmaceutical refined castor oil, untreated, was clear, but of a considerably thicker consistency.

No. 2 Sample.—Crude castor oil, treated by the "Dickinson" Radio-Active Process, was clear, but had thickened a little—less than No. 1 Sample.

No. 3 Sample.—Pharmaceutical castor oil, from the Royal Aircraft Factory, South Farnborough, untreated, was clear, but had thickened slightly (*i.e.* less than No. 2).

No. 4 Sample.—Pharmaceutical refined castor oil, treated by the "Dickinson" Radio-Active Process, was clear, having no trace of thickening.

General Remarks.—We found the "Treated" oil (*viz.*

“ A NEW ACTIVITY ?

No. 4 Sample) the clearest and best, being unchanged from its normal viscosity.

" (Signed) C. J. ELMS,

Manager, The Brighton Pure Ice Co., Ltd.,

The Sussex Cold Storage and Markets, Ltd.

(Signed) FRANK A. HOTBLACK.

I have pleasure in certifying the above details accurate.

(Signed) W. H. BACON,

Brewer and Chemist,

Cannon Brewery, Brighton.

(Report Z. Page 128.)

REPORT ON THE DE-INKING AND PULPING OF NEWSPAPERS, ETC., BY MRS. DICKINSON'S " RADIO-ACTIVE " WATER ONLY.

Department of Superintendent of Paper,

H.M. Stationery Office, Westminster, S.W.

H. A. Bromley, Esq., F.C.S. (of the above Paper Branch, having previously seen and examined paper de-inked and pulped in a few minutes only by Mrs. Dickinson's " radio-active " water in a simple apparatus at Brighton), in a letter to Mrs. Dickinson, August 27th, 1918, says :—

" . . . I have further recommended a trial of your process over a period of time and under actual working conditions. . . .

" . . . I do not, however, judge the merits of your very remarkable material merely upon the results given in this Process. I feel that there must be still more satisfactory outlets for its energy. . . .

" . . . I say this, because from a purely scientific standpoint I have been exceedingly interested in it. . . ."

(Report AA. Page 130.)

INCORPORATED INSTITUTE OF HYGIENE.

No. 3528.

Year of Issue, 1914.

This is to certify that the " Dongor " Antiseptic Cream of Messrs. The Dongor Hygienic Co., Ltd., of Brighton, has been passed by the Examining Board of the Institute of Hygiene

as fulfilling the Standard of Hygienic Merit required by them, in evidence of which the Council have affixed the Seal of the Institute hereon.

Issued this Seventeenth day of November, 1914.

By order of the Council.

V. GRANT RAMSAY,

General Director and Secretary.

The conditions under which this Certificate is granted may be had on application from the Secretary of the Institute of Hygiene, London, W.

Extract from "Brighton and Hove Society," April 23rd, 1914.

DONGOR SOAP.

The really extraordinary cleansing properties of this soap were well shown last week in its action on wool, but its qualities go much further. It cleans anything it touches. If applied to a dirty carpet the colours at once reappear in all their pristine freshness. It is equally valuable in cleaning tapestry, paint, and even metals. In fact it expels dirt from anything to which it is brought in contact, and what makes this the more remarkable is that it contains no sodas or alkalis, and therefore Mrs. Dickinson claims for it the title, "The World's Purifier."

THE CIVILIAN FORCE.

*Headquarters : Aldwych (late The Rinkeries),
London, W.C.,*

November 19th, 1914.

Mrs. Maude Dickinson,
159, Marine Parade, Brighton.

Dear Madam,

On behalf of the Grand Council I desire to tender you our sincere thanks for your handsome gift of Antiseptic Cream, which will be most useful for our Hospital, as it is highly appreciated by the chief of our Nursing Staff.

I am, yours faithfully,

ARNOLD STATHAM,

Chairman.

(Page 125.)

ASSAY OF ARSENICAL ORE TREATED BY THE "DICKINSON" RADIO-ACTIVE PROCESS.

Weight and Description of Charge.	Remarks.	Result.
No. 1. 1 oz. Average sample Com. Prysor Arsenical Gold Ore.	Roasted in dish be- fore fluxing, Bead scorified.	Whitish Yellow Bead, say $\frac{1}{2}$ oz. 1 ton.
No. 2. 1 oz. of lumps of Com. Prysor Gold Ore after treatment by Radio- activity.	All the lumps pow- dered fine in iron mortar reduced to 1 oz. which was then roasted in dish before fluxing, Bead scorified.	Whitish Yellow Bead, say $\frac{1}{4}$ si of No. 1 Bead.
No 3. $3 \times \frac{1}{16}$ phial of coarse Arsenical Pyrites $\frac{1}{2}$ of phial used, remainder left in phial.	Not roasted, lead button too brittle, scorified, and then it was brittle.	Whitish Yellow Bead, say ten times size of No. 1 Bead.
No. 4. Small quantity of mo- derately coarse crushed stuff in bottom of phial.	Not roasted. Not scorified.	Whitish Yellow Bead, say $\frac{1}{4}$ size of No. 1 Bead.
No. 5. Small quantity of fine yellowish stuff in bot- tom of phial.	Not roasted. Not scorified.	Atom discoloured.
No. 6. Small quantity of apparently clean Quartz Tailings in bottom of phial.	Not roasted. Not scorified.	Whitish Yellow Bead, say $\frac{1}{4}$ size of No. 1 Bead.

(Signed) R. LIGHTFOOT.

Panorama Mine, Barmouth,
November 4th, 1914.

(Report BB. Page 126.)

Arms Tor, Bridestowe, Devon,
January 14th, 1919.

Re Ore.

*Extracts of letter from Mr. Julius Moeller (Chemist to the
Duchy of Cornwall) to Mrs. Dickinson.*

"With the ore (Spanish) there is no doubt that a very strong action of disintegration takes place, but as yet I have not been able to state whether the changes are merely of physical or chemical nature. . . . etc.

"Certain it is that the water (radio-active) has a most unexpected effect. . . ." etc.

(Report CC. Pages 135, 136.)

MRS. DICKINSON'S RADIO-ACTIVE WATER.

F. W. Keeble, Esq., The Manor House, Tatsfield, the eminent Scientist, writes :—

"The activity you show in the water, etc., and its use with Spa waters (artificial) seems to me to be a most important consideration, as such waters have hitherto been defective through the absence of slight traces of Radium, which is said to exist in the natural mineral waters."

Wakefield Road, Brighton,
July 14th, 1917.

The Dongor Hygienic Co., Ltd.,
Brighton.

Dear Sirs,

I have great pleasure in testifying to the curative and beneficial results I have experienced from the use of your Radio-Active Water.

In my case, it eliminated from the system Gout and Acidity, from which I had suffered for a very considerable time ; and its purifying properties keep the kidneys perfectly healthy.

Yours faithfully,

(Signed) H. L. CONSTABLE.

Vere Road, Brighton,

January 15th, 1919.

The Dongor Hygienic Co., Ltd.,
Brighton.

Dear Sirs,

It gives me great pleasure to tell you how much I have benefited by having your Radio-Active Table Water. Three years ago I could not go up or down stairs without pain ; and my fingers are much better. It is a splendid water for Rheumatism and Gout.

I have recommended it to my friends.

(Signed) H. SPENCER-THOMPSON.

Arundel Terrace, Kemp Town, Brighton.

January 9th, 1919.

To Messrs. The Dongor Hygienic Co., Ltd.,
Brighton.

Dear Sirs,

I have much pleasure in recommending the Dongor Radio-Active Water. I have received much benefit for my diabetic illness, and have been able to eat and drink many things from which I have been obliged to abstain. I appreciate very much your kindness in introducing the Radio-Active Water to me, and it will be my pleasure and duty to recommend it to any one I know suffering from my complaint.

Assuring you again of my thankfulness,

I remain, Dear Sirs,

Yours faithfully,

(Signed) H. V. WESTERBORG.

(Report DD. Page 139.)

THE " DICKINSON " RADIO-ACTIVE WOOL CLEANING PROCESS.

Cliff Mills, Pudsey,

November 9th, 1917.

The sample of wool you despatched on October 23rd has come to hand, and is a great improvement on the previous sample.

The condition of the wool is all that we could wish, and we shall be interested to hear the result of your further research.

(Signed) WILLIAM LUPTON & CO., LTD.

One of Mrs. Dickinson's Papers.

ORGANIC RADIUM.

PAPER BY MRS. M. DICKINSON, ON HER DISCOVERY.
(FEBRUARY 23RD, 1918.)

I have given the name of Organic Radium to the radio-active substance discovered by me, in contradistinction to the Radium extracted by Professor and Madame Curie from pitch-blende, an *inorganic* substance, owing to the fact that while I was experimenting with a certain organic material I noticed that small crystals were deposited on its surface. I collected these crystals, which scintillated in the light, and I came to the conclusion that, in all probability, the antiseptic properties of the material that I have mentioned might have been due to some radio-activity inherent in the crystals. If these crystals had radio-active qualities, it was important that this should be verified by an examination of them in a spinthariscopescope. For the benefit of my hearers, I would say that a spinthariscopescope is an instrument devised by Sir William Crookes for seeing the action of what are called "alpha" rays upon a zinc-sulphide screen. The instrument consists of a small tube, at the bottom of which is placed the zinc-sulphide screen. At the upper end of the tube there is a magnifying glass, through which one looks to see the action of the portion of radium which is suspended on a small rod between the magnifying glass and the zinc-sulphide screen. Radium is continually radiating with great velocity what are called its alpha rays; as these rays strike the zinc-sulphide screen, they produce luminous scintillations.

It was important, as I have said, to ascertain whether my Organic Radium possessed the power of producing these scintillations, and thus demonstrate one of the qualities of radio-activity. I therefore called upon Messrs. Beck and Co., the well-known opticians in Cornhill, London, and took some of my crystals with me, asking them to place them, in my presence, in some uncharged Crookes' spinthariscopescope—which they did, and I was much gratified to find that my crystals showed the characteristic scintillations on the zinc-blend screen. I submitted the spinthariscopescope containing my Radio-Active substance to some of the most eminent scientific men, and they each observed the scintillations.

There are other characteristics which show the analogy between Radium and my Radio-Organic substance, which have been detected by Mr. Baggally, who has been for some

time investigating my research, and which he will mention after the reading of my paper. Mr. Frank Hotblack has also been, with Mr. Baggally, for some time experimenting with respect to the application of the properties derived from the substance from a scientific and commercial point of view. He also will give, at the end of my paper, an account of some of his experiments in scientific operations.

You may remember that on the 22nd of January, 1916, I gave an address before this Society on my discovery of Organic Radium. I then discussed some of the properties which, from numerous experiments that I had carried out, I found it possessed.

I will now give an account of some of the results. These may be stated under two headings, viz.:—First, those results obtained in experiments carried out with inorganic matter; and second, those results obtained with organic matter.

The results have been more numerous under the second heading, doubtless because my time has been given up principally to these. Ordinary Radium has the property of rendering substances brought within its vicinity, Radio-active temporarily. I have found that my Organic Radium also possesses this property, but unlike ordinary Radium, the induced radio-activity is retained up till now, and I have no doubt that it will continue permanently. It is by various methods I have devised of using the radio-activity resident in the water which I have rendered radio-active, that the results on inorganic and organic substances have been obtained by me. I will now enumerate some of the results. First, with regard to inorganic matter, there is the removal of corrosion from tubes and boilers. My method has given most satisfactory results in this respect, and I hold reports from the Locomotive Inspector of one of our principal railways (these reports can be seen).

Secondly, the treatment of lubricating oil used on engines. I have treated this oil by my radio-active method; and I have a report from the Inspecting Engineer of the same railway (who has personally experimented with it), in which he states that the original stickiness, which in a little time corrodes and retards the syphoning, is removed. He also points out that the air pump on which it was also tried, *i.e.* the donkey engine, in every instance worked well and equally efficiently as with a more expensive oil. He also says this experimental oil shows no signs of corrosion. Mr. Baggally had an interview with the Inspecting Engineer referred to, and received from him a detailed report confirming my statement as to the enhanced value of the treated lubricating oil in question.

Thirdly, a remarkable property is possessed by my radio-active water in resisting the action of cold. Experiments have been carried out by a well-known firm in Brighton, and in their report they state that the sample of the water, radio-actively treated, remained unfrozen, while the ordinary treated water was a block of ice, both being subjected to identical conditions. Analysis showed the treated water was otherwise normal physically. I have so far mentioned my experiments on inorganic matter: I will now proceed to deal with some of those carried out by myself on organic substances.

Firstly, I have succeeded in having bread made without yeast, owing to the fact that radio-active water sets up a fermentation. I sent a number of loaves of bread to our prisoners of war in Germany, and the loaves arrived there quite fresh. A testimonial has been received by me from the Secretary of the Soldiers and Sailors Help Society, which states that the bread kept so very fresh that our interned men in Germany were able to enjoy it even after it was three weeks old. I have numerous testimonials, from all parts, of the good qualities of my yeastless bread, which I shall be pleased to show to any one interested in this branch of my research.

Secondly, during the course of my experiments I have found that the most dirty wool from the sheep becomes perfectly cleaned by a simple process occupying but a very short time. I hold a report from one of our largest wool mills in the North of England. For this firm I treated a quantity of wool. They state in their report, "The condition of the wool is all that we could wish, and we shall be interested to hear the result of your further research."

Thirdly, with regard to the use of the radio-active water for fertilisation, it has been found that the growth of plants has been considerably increased. I have made personal experiments on vegetables on an allotment of ground I hold, and without the use of phosphates, manures, etc., the crop was highly satisfactory. I quote an extract from a letter received by me from a well-known botanist, in which he says, "The cake of loam you sent (treated with your radio-active water) has given very good results in the growth of flowers."

At the present moment experiments are being carried out on barley, under strict test conditions, in which case the treated barley shows increased advance in growth and vitality compared with the untreated, and so far the experiments have been most favourable.

The Radio-Active Water, as a table water, in softness and purity has great value. It has an exhilarating effect, not a

depressing one. It also has great medicinal qualities. I have testimonials to this effect.

The Antiseptic properties of this newly-discovered Organic Radium are great. A gentleman who, I believe, is present, and who is in charge of an important Ambulance Department, will verify this statement, as he has not only cured himself of a long-standing trouble by its use, but has treated over 1000 cases with most beneficial effects, only two being unsatisfactory.

On a previous occasion, I promised I would lay before the Society the commercial advantages of my newly discovered radio-activity, and that is what I have endeavoured to do in this paper; but it must be clearly understood that the experiments described were only carried out by me to demonstrate the inherent properties and force of my radio-active substance when applied to matter both organic and inorganic. I hope, on a future occasion, to lay before this Society the results of other experiments which I have conducted, and upon which I am still engaged.

(Page 102.)

Grosvenor Hotel, London, S.W.,
March 8th, 1917.

The Dongor Hygienic Co., Ltd., Brighton.

Dear Sirs,

I received the tins of Ointment, and am enclosing a remittance, for which I hope you will send me two more tins.

I have recommended it to a friend of mine, and he has asked me to get him a supply. I cannot say how thankful I am to you for it; it is such a wonderful remedy.

Thanking you once again,

I am, Sirs,

Yours very faithfully,

(Signed) C. ROPER.

(Page 54.)

Professor Wintour F. Gwinnell, B.Sc., F.G.S., says:—

The liquid used in Mrs. Dickinson's interesting experiments appears to be radio-active, but the nature and source of the radio-active substance could only be determined by analysis. It may be radium or thorium, etc.

W. F. GWINNELL.

(Page 142.)

Professor Wintour F. Gwinnell, B.Sc., F.G.S., etc. (Science Master, Polytechnic College, Regent Street), writes :—

" . . . Although I have taught Chemistry for a number of years, fourteen at one Institution, I would not undertake to analyse what may be an unknown substance, or mysterious compound. . . ."

Francis W. Keeble, writes :—

" The colour in liquid is no doubt due to the bronze being dissolved by the organic acid set up and condensed into probably a Carbonate or other salt.

" An organic equivalent of Radium.

(Signed) " F. W. KEEBLE."

REMARKS MADE BY SCIENTIFIC MEN UPON THE " DICKINSON " RADIO-ACTIVITY.

" If this discovery can be proved to be Organic it is the discovery of a New World, but it is too gigantic even to dream of."—SIR JAMES DEWAR.

" It (the radio-activity) is not manufactured, it is a new discovery."—SIR OLIVER LODGE.

" The results you have obtained are simply astonishing, but until I know more of the source of this radio-activity, it is impossible to say whether you have made a new discovery or not."—SIR WILLIAM BARRETT.

" This discovery does more than was ever expected from Radium, when Radium was discovered."—PROFESSOR F. W. KEEBLE.

" It is a mystery."—PROFESSOR W. F. GWINNELL.

" This is not Radium, it is a new discovery, and not to be mentioned in the same breath."—JULIUS MOELLER.

And many others.

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